RAILROAD BUILT IN 1904.

Official returns from the majority of the railroad companies in the country, supplemented by our own records and figures furnished by the State Railroad Commissions show that approximately 3,832 miles of new main track have been built in the United States during the calendar year 1904. These figures do not include second track, sidings nor electric lines. The sum total is the smallest reported since 1898, when 3,265 miles were built. The falling off from last year amounts to about 33 per cent. and is undoubtedly due to the suspension of work by some of the larger railroads on all construction which was not absolutely necessary until such time as the business outlook warranted the completion of the work. A concrete example of this is the Chicago, Rock Island & Pacific, which suspended work early in 1904 on its proposed line from Amarillo, Tex., to Tucumcari, N. Mex., 111 miles, on which grading had already been about 50 per cent. finished. Another example of this retrenchment policy as affecting construction is the Pennsylvania System, on which all work which not absolutely necessary was stopped. In this connection, it is interesting to note that the Pennsylvania has recently given orders to resume work on the low-grade line between Parkesburg and Columbia, this being a part of the construction work which was stopped early in 1904.

New main track mileage is reported in 43 states and territories, including Alaska, where 15 miles of new track were built. Texas leads the list with track laid on 323 miles, a slight decrease over 1903. Missouri is second, with 270 miles; Mississippi third, with 268 miles, and Minnesota fourth, with 221 miles. The largest decrease is reported in Oklahoma Territory, where only 163 miles were built, as compared with 661 miles in 1903. This is largely due to the fact that several of the leading railroad systems, including the Atchison, Topeka & Santa Fe, the St. Louis & San Francisco and the Chicago, Rock Island & Pacific reported the completion of their new lines in Oklahoma in 1903, and, owing to the unsettled times, did not begin any fresh work this year. In addition to the above mileage reported, California, Nevada, West Virginia, Pennsylvania, Indian Territory, Illinois, Arkansas, Colorado, Louisiana, Alabama and Georgia built over 100 miles of main track in 1904. No new mileage was reported in Connecticut, Delaware, Massachusetts, New Hampshire, Nebraska or Vermont. The number of miles built in Canada was 316, as compared with 687 last year. Mexico also shows a decrease, the mileage built being 116, against 299 in 1903. The following table shows our figures for mileage built in the United States during the last twelve years:

1893	3,024	1899	4,569
1894	1,760	1900	4,894
1895	1,428	1901	5,368
1896	1,692	1902	6,026
1897	2,109	1903	5,652
1898	3,265	1904	3,832

A table of this year's mileage, classified by states, is given elsewhere in this issue.

ARE RATE-MAKING COMMISSIONS SUCCESSFUL?

It is an interesting phenomenon, in connection with the agitation for the enlargement of the powers of the Interstate Commerce Commission, that so much effort is expended in the exploitation of the evils alleged to exist that none is available to show the applicability of the proposed remedies. Without for a moment admitting that the frictional evils incident to the mutual adjustments necessary between a rapidly developing transportation system and an industrial organization, of which the former is a part, which is moving forward with equal speed, are as great as the proponents of the Quarles-Cooper bill contend, it is worth while to ask whether, if they were, the remedy proposed would correct them. Thirty states of the American Union now have railroad commissions, and in twenty-two instances these commissions have rate-making powers. Would it not be reasonable to investigate the results in these states before adopting similar legislation concerning interstate commerce? Such data as are now available indicate that official rate-making has not been very satisfactory to those states which have tried it. Georgia, for example, was one of the earliest states to adopt a drastic railroad commission law, and has consistenly followed the plan of interposing its authority between the buyers and sellers of railroad transportation. Yet the newspapers of Georgia to-day declare that the shippers of that state pay more than their neighbors in adjoining states, and that interstate traffic, which the Interstate Commerce Commission so loudly complains is not subject to effective regulation, is carried similar distances at much lower rates. A recent editorial in the Atlanta Journal contains the following:

> A merchant in Marietta can ship certain goods to Chattanooga for fifteen cents per hundred; to Knoxville for nineteen cents per hundred. To ship the same goods to Atlanta, he must pay thirty cents per hundred; to Macon, seventy cents per hundred. Atlanta is twenty miles from Marietta; Chattanooga is one hundred and twenty-eight miles, and yet the Chattanooga merchant pays just one-half the freight the Atlanta merchant does. Why? Because Chattanooga is out of the state and Atlanta is in it. This is merely one of a hundred instances where Georgia points are placed at a positive disadvantage in freight rates, because they are located in the state.

The editorial from which the foregoing is an extract shows traces of feeling which suggest the attitude of an advocate rather than one of judicial impartiality; but in spite of this it is clear that the results of a drastic regulative system are not now wholly satisfying to the people of Georgia. It has been suggested that the psychological aspect of railroad regulation of this sort is too often ignored, and that where the reduction of rates is more or less vigorously looked after by public authorities, railroad officers are not unlikely to leave the duty of looking for desirable reductions wholly to the body with which the legislature has required them to share it. Something of this sort seems to have occurred to the shippers of Georgia, for in the editorial already quoted there appears the following explanation of the situation against which the complaint is made:

> . . . when a merchant approaches the railroad for rates in Georgia, he is met with the reply that the railroad commission regulates that, and he can get no reduction.

If, however, they are asked for rates to towns outside of Georgia, the application receives immediate and favorable consideration, and the best rates are granted, because the point of destination is beyond the limits of the state, and therefore not controlled by the State Commission.

In another paragraph of the same editorial the situation is summarized with similar effect, and perhaps even more forcibly as follows:

> As matters now stand the plain logic of the situation is that within the state of Georgia, rates being regulated by the railroad commission, shippers are powerless to receive fair treatment from the railroads, while to points just beyond the limits of the state they can receive the most favorable rates, and shippers from these points into the state receive the lowest rate than can be obtained; much lower, as a rule, than the Georgia shipper can get.

Anyone would underestimate the significance of the foregoing who failed to note that the state rates and the interstate rates are over the same railroads and must be promulgated by the same officers; the controlling, and, in fact, the sole difference being that in the case of the interstate rates the shippers deal at first hand and face to face with the railroads and their officers, while in the case of the state rates the legislature has interposed its authority, and that of the State Commission, between the two actual parties to every contract for railroad service, thus requiring the negotiations to be conducted at much more than an arm's length. The method of doing business thus imposed upon the shippers of state traffic, and the railroads carrying it, is cumbersome and absurd; it is only natural that its consequences should be so burdensome.

If rate-making power is conceded to the Interstate Commerce Commission the shippers of interstate freight may find themselves in the situation that is now distressing the local shippers of Georgia. Left to himself, the competent railroad rate-making officer devotes much time and thought to the search for opportunities to assist in the development of the regions contiguous and tributary to this system and to increase net revenue by reducing rates. In order to avoid overlooking any such opportunity his door is always open to those who seek reductions, and he investigates patiently every industrial situation that affords even the most meagre promise of additional traffic in return for lower rates. The creation of an official board with authority to compel reductions transforms such an enlightened and useful officer into an advocate of the existing rates. He is told, in effect, that the state will look out for the needs of business in the way of reduced rates of transportation, and he knows that, until driven to plead confiscatory taking of property without due process of law at the bar of justice, the revenues of his corporation will have no defender but himself and his fellow officers. He knows that a justifiable reduction will be made an argument for others that are wholly devoid of justification, and he naturally assumes an attitude of hostility to all reductions. Again, capital is reluctant to engage in railroad enterprises where the rate-making power has been taken from its employees and lodged in political officers, and the states which have the most drastic regulative laws have usually seen the slowest development of railroad facilities, with the natural accompaniment of slow development, the retardation of the natural decline in rates.

THE GOVERNMENT AND RAILROAD ACCIDENTS.

Since the first day of last July there have been in this country seven important train accidents, killing 252 persons and injuring over 500. These accidents have been put so prominently before the public that they have called out vigorous inquiries and criticisms concerning their causes.* Similar but less severe "epidemics" have occurred before. But this particular series of accidents, following ten very bad ones in the year ending June 30, has aroused an unusual interest. By October, when the facts concerning the Newmarket and Warrensburg collisions became known, the state of public opinion had become so pronounced that President Roosevelt referred to the subject in his annual message to Congress; and as 140 of the 252 fatalities were due to collisions, and 8 of the 10 accidents in the preceding year were of this class, he quite naturally indorsed the recommendation of the Interstate Commerce Commission that a Federal law be passed to enforce the use of the block system. This proposed law, it may be observed in passing, is a rather mild one (it was printed in the *Railroad Gazette* of January 1, 1904).

This action of President Roosevelt has drawn from Mr. Slason Thompson, of Chicago, an angry protest, which he has presented to the Western Railway Club in a paper, the main parts of which we reprint in another column. Mr. Thompson will be recollected by our readers as the author of a paper last February (*Railroad Gazette*, page 112), containing some utterly worthless comparisons between the accident reports of the British Board of Trade and those of the Interstate Commerce Commission. He makes some other comparisons of a similar kind now; and they are equally worthless. He does, however, make comparisons of one year with another, in the records of this country, in more rational form. He shows, what it was hardly necessary to show, that in the last 14 or 15 years the fatalities to passengers and employees, as recorded in the Government Annual Reports, have not increased so fast as the volume of traffic has increased; though he does not bring his comparisons down to date, and so omits two disasters, killing four score people, which have been the most potent factors in arousing public indignation. He also has found 35 roads, operating 31,000 miles of line, on which not a single passenger was killed in a train accident during a whole year. The density of passenger traffic on these 35 roads is about the same as in Group 3 (Ohio, Indiana, Michigan). But all these comparisons are almost valueless because they afford no new or useful lessons; and Mr. Thompson, as a quasi representative of the railroads, does harm by perpetuating a seeming disagreement among railroad interests. In trying to get up a quarrel with the Interstate Commerce Commission he wearies the Western Railway Club with a lot of irrelevancies. No American railroad officer finds satisfaction in the accident statistics either of this country or of England, whether interpreted by Mr. Thompson or Mr. Moseley, or the Secretary of the British Board of Trade. Practically all progressive railroad men are agreed that the block system ought to be rapidly extended. The most outspoken among the railroad officers who have complained that the Interstate Commerce Commission is crying too loudly for the adoption of the block system, is the managing officer of a company which has already determined to block signal all of its main lines as soon as possible and to increase its block signaling more than 100 per cent. within the next six months.

We do not take the reader's time to verify Mr. Thompson's percentages or to refute his grotesque conclusions, for any reader who has considered the facts must see without assistance the inapplicability of these conclusions. What sense can be made of the assertion that "in three cases out of four" the value of the block system is neutralized by the failure of the men who work it? He praises the Board of Trade for saying that the railroads of England cannot reduce their collision record by the adoption of new methods of operation; but to properly illuminate this statement one must add that the most important "new method," the block system, has been adopted already.

The Interstate Commerce Commission rightly omits from its discussions the trespassers killed and injured, because these figures do not affect the main question. (What Mr. Thompson means by charging that trespassers' casualties have been attributed to the lack of the block system, is a mystery.) The Commission is also right in omitting derailments, for the reason that the prevention of derailments is a complicated question which the Government is not dealing with. And, finally, it could very reasonably omit its tabular statistics altogether and confine its attention entirely to the dozen notable collisions. These are what have aroused the public, and the causes of these are what everybody desires to grapple with. It may be true that the train despatchers of America, performing highly exacting duties with great fidelity and skill, have come out successful 999,995 times out of a million. But if the other five cases produce disastrous butting collisions, and the collisions cause harrowing scenes of death and suffering; if a change of system reduces the errors from five in a million to one in a million, and the new system has a record of years to prove its merits, the public will demand the change.

*One of these accidents was the flood disaster in Colorado, killing 94; but the others were due to causes constantly recurring.

RAILROAD SHOP TOOLS.

Those who have followed the articles on 'Railroad Shop Tools" printed in the *Railroad Gazette* during the past six months, could not have failed to notice the marked similarity in the general design of different makes of tools of the same type. This similarity is due to the fact that modern machine tools have the same essential parts that they had ten years ago. For example, a shaper still consists of the base, the ram, the cross rail, the table, the head, etc. Of course, the modern machine tool is a much more efficient machine, owing to the number of important improvements and differences that are to be found in the details of its design, such as labor-saving devices, different types of feed and adjusting mechanisms, etc., all of which go to reduce the cost of production. The latest machine tools are heavier and stronger than those designed several years ago. This is due to the fact that the makers give attention to the increased stresses which are imposed on the different parts of the machines owing to the wide use of modern high-speed tool steel. Before the advent of high-speed steel most machine tools were designed more or less by the "rule of thumb" method; but now the makers realize that their designs must be based on thoroughly scientific principles, so that the metal will be placed where it will do the most good. Almost every type of modern machine upon the market is equipped with some sort of a variable speed mechanism. These devices are thought by many to be more of a fad than an actual necessity, especially in railroad shops, where, as a rule, each machine is bought to do a special class of work. Of course, where a machine handles a wide range and variety of work a variable speed attachment is useful. In general, however, a few speed and feed changes will meet the requirements of railroad shops. A marked increase in the number of direct connected, motor-driven tools is noted. This type of drive is efficient and convenient, especially for heavy isolated machine tools, as it makes it possible to place them in the most advantageous position regardless of line shafts. For the smaller tools it is still a question whether a direct connected drive is the best method. It is generally admitted, however, that small tools should be group driven. When the group drive is employed, constant-speed motors are used. It is best to use the same size and make of motor for driving each group, thereby reducing the number of repair parts to be carried in stock. New tools should also be selected so as to minimize the variety of designs. This practice will be found particularly economical in cases where jigs are used, for then the jigs can be made to fit more than one machine. Many machine tool users are demanding positive drives and feeds. Positive feeds are a necessity in many cases—as, for example, when fine, accurate work and thread cutting is to be done—but on the larger machines where precision work is not essential, the friction drive, whether a belt or disc, is preferable, as it acts as a safety device when the tool becomes jammed and will relieve the machine of dangerous strains. Two machines which have been described in the *Railroad Gazette* that are gaining in popularity in railroad shops, are the horizontal and vertical turning and boring mills. These machines are now used for turning cylinder ring castings, boring out driving boxes, etc., work which was formerly done on a lathe. The double-head boring mill is especially useful in many cases, and the ease and quickness with which work can be chucked on this type of machine, has had much to do with their almost universal use. Because of the great variety of work which these machines are called upon to do, it may almost be said to be an unwritten rule never to chuck a piece of work vertically, as in a lathe, when it can be chucked horizontally, as in a boring mill.

Several months ago we had occasion to point out the absurd disparities and blunders in the annual reports of the Railroad Commission of Connecticut. The report for 1904 just published brings some of those

flaws out in grotesque relief. The report for 1902 returned the "average cost of the equipment" of the steam roads of the state at $6,984 per mile (cents omitted). This item was changed in the report of 1903 to $84,848 a mile, which now drops (for 1904) to $13,624 a mile—itself almost double the return for 1902. In other words, if we take these astonishing returns as an index, the equipment of Connecticut's steam roads increased about twelve-fold one year and fell some 84 per cent. the next. Such dizzy vagaries of "official" figures the statistician may well be excused from further analyzing. Again, another point of our attack was a huge blunder of the Commission last year (1903) in the simple addition of its own figures showing capitalization per mile of the electric roads of the state in stock, bonds and floating debt. In its report now (1904) the commission balks at that simple summation of mileage capitalization and shifts the process to "cost of construction and equipment," $86,612 a mile, a big leap from the $80,773 returned last year for the same item and a still more fantastic contrast with the blundered $71,728 returned last year for stock, bonds and floating debt capitalization combined. The Commission, however, this year sets up a kind of apology in a statement that the inclusion of gas, electric light, water and power plants "plays havoc" with the Connecticut street railway statistics, and it very gently lays the blame on the State Legislature. But when did the Connecticut Railroad Commission ever seriously press that matter on legislative attention? When did it suggest or bring forward a remedial or preventive measure? What has it ever done to thwart the enormous over-capitalization of Connecticut trolley roads, and what general policy of any kind has it ever urged or adopted? At the time when the State Legislature ordered street railway returns to be made did not the Commission leave to the voluntary initiative of a private citizen the measure which compelled those returns to be printed? But words are almost wasted in commenting on a commission of such a character. It is simply the by-product of a lax and usually partisan state policy that creates a perquisite in place of what should be an office of useful and exalted public service—a policy by no means restricted to Connecticut. The so-called "political" commission is so familiar an evil that it interprets itself by the simple adjective.

Steel sheet piling for foundation and caisson work is of comparatively recent origin, but because of its manifest superiority over timber sheet piling in a great number of applications it has met with the approval of contractors and other users and has been extensively employed. The chief advantage claimed for it is that it is practically indestructible and can be used over and over again. It is also claimed that it is driven more easily than timber piling. This claim seems to be substantiated in practice, but the withdrawal of the piling, after the completion of the work, has been found to be exceedingly difficult in a number of cases. This may be ascribed to several causes, the chief of which is corrosion. Steel which is imbedded in damp ground for from one to four months is sure to rust, and this rusting takes place chiefly in the interlocking grooves and on the surfaces next to the earth. When the piling is withdrawn this rusting adds greatly to the resistance and increases the difficulty of pulling out the separate piles. Some little time ago a contractor attempted to withdraw some steel piles which were badly corroded, having been in the ground some time. Bolts 1¼ in. in diameter were passed through holes in the web near the top, and in attempting to pull the piles with these bolts the bolts were sheared off clean. Although the effort was finally successful, the contractor thought that it cost him about as much as the piling was worth to save it. A large user of steel piling has suggested that one way to get rid of corrosion to a large extent is to fill the interlocking grooves with a heavy grease before putting the piles in the ground, and though a large part of this grease would doubtless be forced out in driving, enough would remain on the surfaces in contact to prevent corrosion and to act as a lubricant to facilitate withdrawal. Some designs of interlocking steel piling which are built up from rolled sections, riveted together, are difficult to withdraw because of the increased resistance furnished by the rivet heads. This, of course, could be overcome by countersinking the rivet heads. As a general rule, where difficulty is experienced in withdrawing steel piling because of corroded joints, one or two blows on top of each pile with the hammer of a pile driver, if it is conveniently near, will break the rust joint and loosen the pile from those on each side of it, so that it can be drawn easily and quickly with a steady upward pull with block and tackle, or other means.

As Mr. Slason Thompson mixes some truth with his curious compilations of errors, we have in another article noticed his Chicago paper to the extent of restating the main facts on which is based the demand, constantly becoming more widespread, for the extension of the use of the block system. Mr. Thompson seems to be trying to show that this demand is of no account or does not exist; but he does not disturb the facts, though to the superficial reader he might seem to be doing so. But there is one of his assertions in which he may have the support of some railroad men, and it will be proper to add a word concerning it. We mean the allegation that "the inevitable tendency of the block system is to beget carelessness in the train crews." In another place he seems to think that block signals are likely to "overburden public traffic," meaning, we suppose, that they will delay trains unreasonably. But what particular brand of carelessness is it that so materially improves the safety of passengers? If reference is made to the neglect of rear flagmen to flag, in cases where they know that their trains already have the protection of the block signal, it may be answered that many superintendents who require flagging to be kept up the same with the block signals as without them, do succeed in enforcing flagging as well as before. This indicates that the trouble is with the superintendent, not with the system. Something seems to "beget carelessness" in trainmen under all systems, unless the superintendent keeps after the men constantly. One great merit of the block system is that the superintendent can readily watch the men on whom he depends for the protection of his trains from collision, whereas under the old system he must always depend largely on the flagman, who performs his duties under such varied and elusive conditions that it is difficult to watch him effectively. Neither is the block system responsible for delaying trains. It is possible, of course, to make block sections long enough to keep trains an hour a part. But, on the other hand, it is possible to make them short enough to reduce the time interval between trains to two minutes or less. No rational minded superintendent is going to blame the system for the length of his block sections; he knows that the trouble is due to his own attempt to accomplish the impossible; to secure both safety and celerity without increasing his expenses. Where trains are run at 30 miles an hour four minutes apart, they may with good luck get along for years without the block system, for they will usually be about two miles apart. But if the road decides to abandon dependence on luck, introduces the block system, and sets the signals four miles apart, the time interval must at once be lengthened to eight minutes. There is no mystery about this. The capacity of the road is reduced 50 per cent. On the other hand block signals one mile apart would increase the capacity of the road approximately 100 per cent. as compared with the four-minute time interval.

NEW PUBLICATIONS.

Locomotive Operation. A technical and practical analysis. By G. R. Henderson. Chicago: The Railway Age, 1904. Cloth, 536 pages. Price, $3.50.

Previous books on the locomotive relate to locomotive design, locomotive running or a combination of these in the form of a catechism intended for engineers and firemen. There is the classic work by Holly and Colburn, which is out of date, and other elaborate works in French and German; but there is no modern work in English in which the subject of locomotive operation on American railroads is treated in such an original and satisfactory manner. The author is a mechanical engineer, well known on account of his valuable reports written for the Master Mechanics' Association on locomotive proportions, tonnage rating, train resistance, etc. He has had a large experience as a machinist, a mechanical engineer and a motive power officer, and has a thorough technical education. The book is written from the technical and practical standpoint, and is intended for the men employed in mechanical departments of railroads, as well as for students in the railway course in technical schools. For the latter, the mathematics necessary for derivation of various formulæ are given in full, and the treatment is as scientific as could be desired. For the practical man the final formula is given in simple form for direct application, and much of the information is given in the form of tables and diagrams, from which data can be taken directly. It is exceptionally well illustrated with carefully prepared drawings. It is a complete treatise on the subject of locomotive operation, and the aim has been to apply scientific principles to modern locomotive practice, and the derivation of the formula is given so as to avoid the necessity of reference to other text-books. The book treats of inertia and its application to starting and stopping, centrifugal force on curves, the effect on rods and reciprocating parts, counterbalance, steam action, valve motion quantity of steam, condensation in cylinders, rotative force, pressure on rail, strains induced in pistons, cranks and axles and rods, drifting and relief valves, slipping, traction increasers, steam capacity, hauling, water and fuel consumption.

TRADE CATALOGUES.

Machine Tools.—The Pratt & Whitney Co., Hartford, Conn., sends a pamphlet bearing the title "New Designs." Illustrations and descriptions of engine lathes, turret lathes, shaping machines, milling machines, multiple drills, etc., are given.

Mechanical Stokers.—The Westinghouse Machine Company, East Pittsburg, Pa., sends an illustrated boklet entitled "A Few Words About Mechanical Stokers." A full detailed description of the Roney stoker is given as

well as a number of cross section drawings which show the details of its construction. Illustrations of some important power plants equipped with this stoker are also shown.

Union Pacific issues a 14-page pamphlet giving a tabulated statement of the crop yields of all counties in Nebraska for 1904, McPherson county excepted. The report shows the acreage of all crops produced in the state during the year, with estimates of the yield per acre for each. A similar bulletin has been issued for Kansas, making the eighteenth agricultural bulletin issued by the passenger department, the practice having been only recently begun.

CONTRIBUTIONS

Design for Reinforced Concrete Retaining Wall.

Chicago, Dec. 1, 1904.

To the Editor of the Railroad Gazette:

Considerable data have been published from time to time concerning reinforced concrete structures for all railroad purposes with the exception of retaining walls. In track elevation, concrete retaining walls, usually very massive, are being used quite extensively, and it would appear that reinforced concrete could be used quite economically in such walls, if the volume of concrete could be reduced to some extent, at the same time keeping the cost of supervision, of forms, and the mixing and placing of the concrete the same as for the plain wall. The design presented here was intended to meet these requirements and at the same time have as much, if not more, stability than the average design of retaining wall.

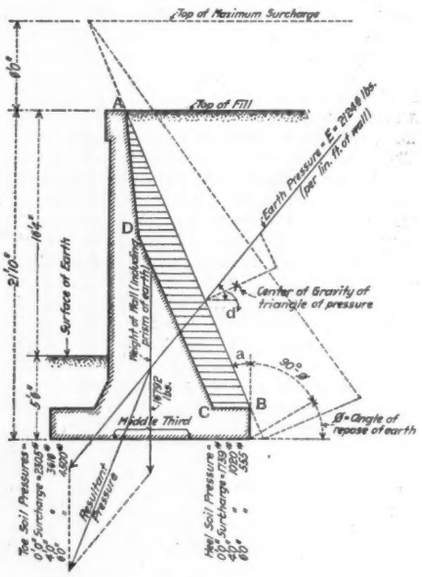


Fig. 1.

The following assumptions, methods of design and ideas of construction, were used in this design:

Type of Wall.—A wall having the same general outline as an ordinary retaining wall, to which any reliable theory could be applied.

Assumptions.—The plane A B (Fig. 1) was assumed to be the back of the wall and the prism of earth A-B-C-D-A a part of the wall. The weight of this prism is less than one-fourth the total weight of wall.

Resultants.—The resultant pressure due to weight of wall and earth pressure (without surcharge) must cut the center, or very near the center, of the base. The resultant due to the above pressures, and including the surcharge, must cut the base inside the middle third. At the same time the allowable soil pressure must not be exceeded at the toe.

Forms and Reinforcing.—The forms must be as simple and readily constructed as those for plain walls. The reinforcing bars must not have any difficult kinks or bends, so as to avoid the necessity of skilled labor in the field.

Volume of Concrete.—The volume of concrete shall not be reduced to such an extent that the cost per yard of machine mixing, handling and placing of concrete will exceed that for a plain wall.

Formulæ.—Retaining wall formulæ were taken from "Retaining Walls for Earth," by Prof. M. A. Howe, and the following are the ones used for the resultant earth pressure and its pitch:

$$E = \frac{H^2 Y}{2} \sqrt{\tan^2 a + \tan^4\left(45^0 - \frac{\phi}{2}\right)}$$

$$\tan d = \frac{\tan a}{\tan^2\left(45^0 - \frac{\phi}{2}\right)}$$

where H = vertical height of wall plus the surcharge.
W = weight of 1 cu. ft. of concrete = 150 lbs.
Y = weight of 1 cu. ft. of earth = 150 lbs.
ϕ = angle of repose of earth = 30 deg.
a = angle back of wall makes with the vertical.
E = resultant earth pressure in lbs. per lineal ft. of wall.
d = angle resultant E makes with the horizontal.

The formula used for the reinforced concrete is by Mr. A. L. Johnson. This formula

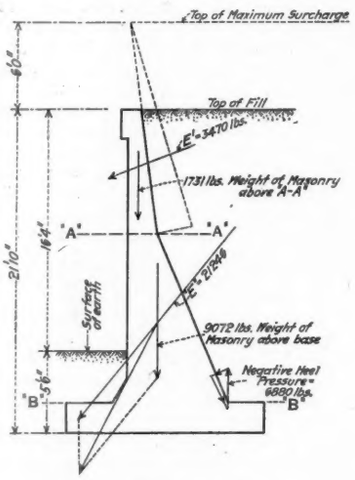


Fig. 2.

can be adapted to either a high or low elastic limit steel.

Unit Stresses.—The metal reinforcing used is a high elastic limit steel and the allowable unit stress for tension is 12,500 lbs. per sq. in., which gives a factor of safety of 4 where the elastic limit is 50,000 lbs. per sq. in. If 32,000-lb. elastic limit steel is used, the allowable unit stress should be 8,000 lbs. per sq. in. in order to have the same factor of safety. The allowable working stress for imbedment of the bars shown is 250 lbs. per lineal inch of imbedment, and for plain material about 160 lbs. per lineal inch of imbedment. These unit stresses are based upon tests made at six of the leading universities of this country, which tests prove without a doubt that the ultimate strength of the reinforced concrete structure is the elastic limit of the reinforcing steel.

The method of procedure was as follows:

Fig. 1 shows the direction and intensity of the resultant for 6 ft. of surcharge. The soil pressure at the heel and toe are shown for 0, 4 and 6 ft. of surcharge. The toe is reinforced for the maximum soil pressure and the heel for the actual weight of the earth prism. Fig. 2 shows the resultant earth pressure, E, applied directly to the back of the masonry and combined with the weight of the masonry above the plane "BB." The resultant pressure cuts the plane "BB" just inside of the masonry at the toe and produces a negative pressure at the heel. Care must be taken not to exceed the allowable pressure on the masonry at the toe in the plane "BB." Reinforcing bars are

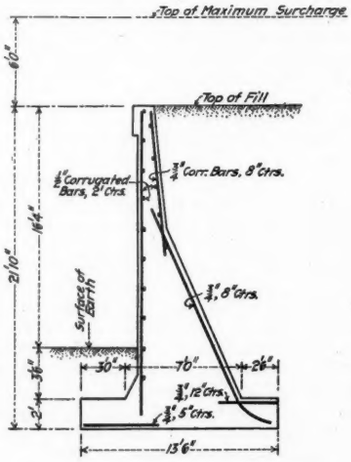


Fig. 3.

to be provided to take the stress caused by negative pressure at the heel. Fig. 2 also shows the resultant pressure on the upper portion of the wall. This portion is treated as a simple cantilever beam.

Fig. 3 shows a cross-section of the completed wall, giving sizes and spacing of reinforcing bars. It is very probable that there should be additional bars placed in the bottom of the wall, running longitudinally, to give additional safety for possible settlement.

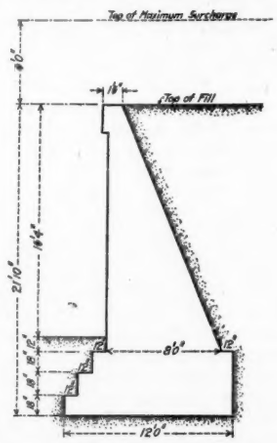


Fig. 4.

Fig. 4 shows cross-section of a plain concrete wall having the same stability as the steel-concrete wall. The following comparison of costs is for the total cost of wall, in-

cluding contractor's profit, and exclusive of excavation.

Plain Concrete Wall, Per Lin. Ft.

		In place.
Concrete	4.8 cu. yd. at $4 per yd.	$19.20
Forms	115 ft.B.M." 31 " M..	3.56
Total		$22.76

Steel-Concrete Wall, Per Lin. Ft.

Concrete	3.45 cu. yd. at $4.10 per yd.	$14.18
Forms.....	115 ft.B.M. " 31.00 " M.	3.56
Steel bars ...	109 lbs. " .03¼ pr lb	3.54
Extra fill	1.34 cu. yd. " .20 per yd.	.27
Excavt'n. ..	0.32 cu. yd. " .20 per yd.	.06
Total		$21,61

These estimates show a saving of $1.15 per lineal foot of wall, in favor of the steel-concrete wall. If the cost of materials is higher, there will be a greater saving made.

F. F. SINKS.

Economic Length of Trestle Spans.

CINCINNATI, OHIO, Dec. 10, 1904.

TO THE EDITOR OF THE RAILROAD GAZETTE:

For the purpose of obtaining the economic length of spans for trestles of various heights, the following estimates were prepared and are submitted as being of value in estimating on the type and span of structures of this kind. The assumed loading is that given in Cooper's latest railroad bridge specifications, class E 50. This loading is gradually coming into almost universal use on the principal American railroads.

With towers 30 ft. center to center of bents, comparative estimates were made to ascertain the economical length of intermediate spans for plate girder construction. The assumed height is 120 ft.

Weight of Steel in Trestles, for Various Lengths of Intermediate Spans.

Length intermediate span.	Weight per lin. ft. of single track, lbs.			
	Spans.	Bents.	Traction bracing.	Total.
30	433	1,130	380	1,943
40	493	1,080	360	1,933
50	556	1,040	345	1,941
60	622	995	324	1,941
70	741	952	315	2,008
80	860	910	300	2,070
90	988	867	285	2,140
100	1,117	800	270	2,187

Taking the cost of steel in place at 3½ cents per pound for girders, and 4 cents per pound for bents and bracing, and the cost of concrete piers in place at $10 per yard, then the cost of trestles for varying lengths of intermediate spans is as follows:

Cost of Steel Trestles 120 Ft. High, for Varying Lengths of Intermediate Spans.

Length intermediate span.	Cost per lin. ft. of trestle.				
	Spans.	Bents.	Traction bracing.	Piers.	Total.
30	$15.15	$45.2	$15.2	$12.00	$87.55
40	17.25	43.2	14.4	10.00	84.85
50	19.46	41.6	13.8	9.00	83.69
60	21.77	39.2	13.0	8.00	82.57
70	25.90	38.0	12.6	7.20	83.76
80	30.10	36.4	12.0	6.60	85.17
90	34.58	34.6	11.4	6.00	86.58
100	39.09	32.0	10.8	5.50	87.39

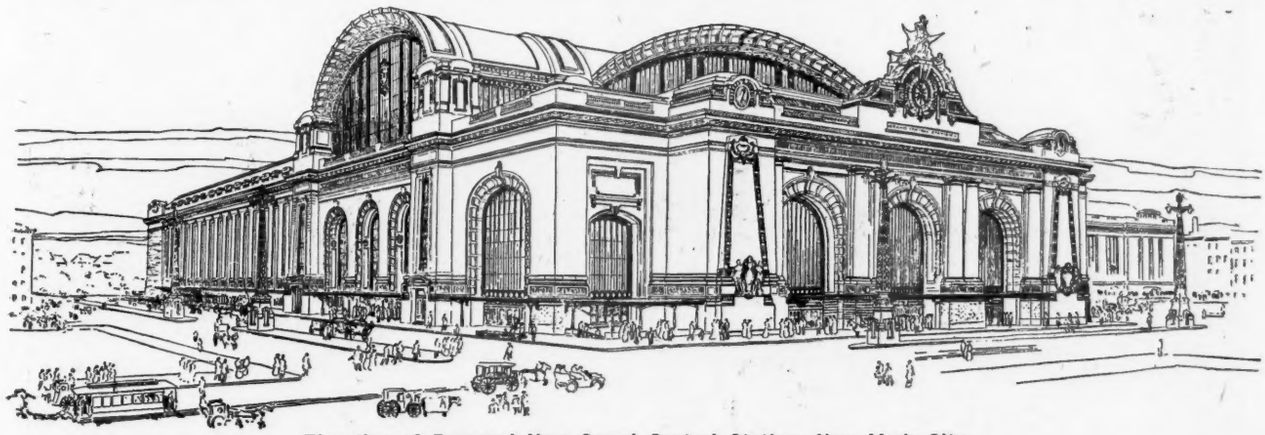
These estimates show that the most economical length for intermediate spans for the assumed height of 120 ft. is 60 ft., though there is no great variation for 10 ft. greater or less length. The decreased cost of spans is balanced by the increased cost of towers and foundations.

As the height of trestles decreases towards the ends, the length of the intermediate spans will decrease also, down to 30 ft. Or if the trestle be low throughout, it will be economical to reduce the lengths of all the spans to 25 or even 20 ft.

H. G. TYRRELL,
CHIEF ENGINEER BRACKETT BRIDGE CO.

The New Grand Central Station.

The New York Central on December 24 submitted to the Board of Estimate and Apportionment of the City of New York for approval the plans of the terminal improvements which are to be made in New York, including the magnificent new passenger station which it is proposed to build on the site of the present station. When the first Grand Central Station was built in 1871 it was considered one of the largest and finest terminals in the world. It covered four acres and had two acres of glass in the train shed roof. In 1899 the station was entirely remodeled and enlarged, but with the constant growth of the through and suburban traffic of both the New York Central and the New York, New Haven & Hartford, which shares the terminal under a perpetual agreement, it has become entirely inadequate to the present or future needs of both roads. In the *Railroad Gazette*, Jan. 2, 1903, a preliminary report of the engineers in charge of the improvement work was published together with a plan of the proposed arrangement of approach tracks, yards and station building. Since that time the plans have been revised and changed in many ways as new problems arose but the general scheme remains the same.



Elevation of Proposed New Grand Central Station, New York City.

The plans submitted for approval by the city contemplate the use of an area of 19 city blocks between Forty-second and Fifty-seventh streets, Madison and Lexington avenues. The station proper, together with the post office and express buildings, will cover the blocks between Vanderbilt and Lexington avenues from Forty-fifth to Forty-third streets inclusive, and the block fronting on Forty-second street between Vanderbilt avenue and Depew place.

The buildings will be set back from Forty-second street about 40 ft. and back from Vanderbilt avenue about 70 ft., so as to afford a generous approach to the station and give the effect of 140 ft. open space on the Forty-second street front and 130 ft. open space on the Vanderbilt avenue front. The frontage of these buildings will be 680 ft. on Vanderbilt avenue, 625 ft. on Forty-fifth street, 460 ft. on Lexington avenue, 275 ft. on Forty-fourth street, 260 ft. on Depew place, and 300 ft. on Forty-second street.

In addition to the public streets, there will be connections by a number of wide private roadways and walks to Madison avenue on the west and Lexington avenue on the east; thus giving the traveling public facilities for entering the station not only from Forty-second street, Vanderbilt avenue and Depew place on the south, but from Madison avenue on the west and Lexington avenue on the east.

The suburban trains will come in on a lower level than the express trains, thus separating the two classes of passengers and affording better facilities for both. The suburban concourse will provide for nine tracks. The express concourse will be slightly depressed below the street level and will provide for 22 passenger train tracks, two baggage tracks, two mail tracks and eight express tracks, making 43 tracks in all, with the platforms so connected by subways and elevators that baggage, mail and express can be quickly transferred without crossing the tracks.

The main entrance to the station will be on Forty-second street. Its architectural composition is three massive arches, each arch being 33 ft. wide and 60 ft. high. Beyond these arches is an enormous ticket lobby 90 ft. x 300 ft. This ticket lobby is on the level with the street. On the right of this lobby, and practically a part of it, is the outgoing baggage room. After purchasing his ticket and checking his baggage, the passenger proceeds to the express trains by entering a gallery overlooking the grand concourse and thence to this concourse, which is on the level of the express tracks. This concourse is approached by four grand staircases, each 25 ft. wide. This concourse is the largest in the world, being 160 ft. by 470 ft. and 150 ft. high, with wide entrances at each end extending to Madison and Lexington avenues. Adjoining this concourse are the usual waiting rooms, retiring rooms, cafés, telephone and telegraph facilities, etc. The waiting rooms will contain twice the area of the waiting rooms in the present Grand Central Station. The departing and arriving passengers will pass through this concourse, but the arriving passengers are separated from the departing passengers, thus avoiding the usual confusion in a railroad station caused by the meeting of incoming and outgoing passengers. In the train shed the platforms are of ample width, averaging from 15 ft. to 18 ft. wide, whereas the narrowest platform of the present station is but 8 ft. wide and the widest is but 12 ft. wide. These wide platforms afford ample facilities for quickly leaving the train and

avoid the usual crowding. The suburban train shed has platforms on either side of the train. These platforms are even wider than the express platforms, ranging from 17 to 29 ft. wide. The concourse end of all express train platforms has the additional advantage of being free from the handling of baggage.

The exit from the station is along Vanderbilt avenue, approached by ample staircases. To the north and along Vanderbilt avenue is the incoming baggage room, conveniently placed for arriving passengers. The company's cab stand is on the level of the concourse and the express tracks. It will be about 100 ft. x 200 ft. and can be reached with equal facility by the suburban and the express passengers.

Besides the main entrances and exits there are additional entrances and exits for the suburban passengers, so that these need not enter the main part of the station, but can go directly from the street to the train or from the train to the street by an easy incline, avoiding all staircases. There is to be provided at the express level a passageway to the subway station. There is also a splendid entrance and exit to the station by way of an incline from Madison avenue, enabling the cab or foot passengers to approach or leave the station at the west end of the grand concourse. At the subway level there is provided a subordinate concourse with ample waiting and retiring rooms. At this level there will be a loop for quickly despatching the suburban trains, and provision has also been made for a possible connection with the tracks of the rapid transit system. Pipe galleries will be run in Forty-second street, Vanderbilt avenue and Depew place.

The baggage room adjoins Depew place, Forty-fifth street and Vanderbilt avenue, with 1,300 ft. of street front and 47,000 sq. ft. of floor space, sufficient to care for baggage in rush seasons without the delay in delivery now experienced at all large stations.

In preparing the plans for the new station everything has been sacrificed to the comfort and convenience of the traveling public. The distinguishing features of the arrangement of the yards, platforms and head house may be summarized as follows: Ample facilities for getting to and away from the station. Cab stand situated in most convenient place for arriving passengers. Outgoing baggage room convenient to the ticket offices and incoming baggage room convenient to the exits. Separation of incoming and outgoing passengers, thus avoiding confusion. Ample waiting rooms and accessories and a grand concourse large enough to accommodate the largest holiday or excursion crowds. Separation of suburban and through passengers but with arrangements for easily getting from one part of the station to the other. Waiting vestibule for those desiring to meet incoming passengers. Ample baggage handling facilities.

North of the main concourse and extending entirely around this part of the building above the level of the train shed will be the company's offices containing about 250,000 sq. ft. of floor space exclusive of corridors. The entrances to the offices will be at Forty-fifth street and Park avenue.

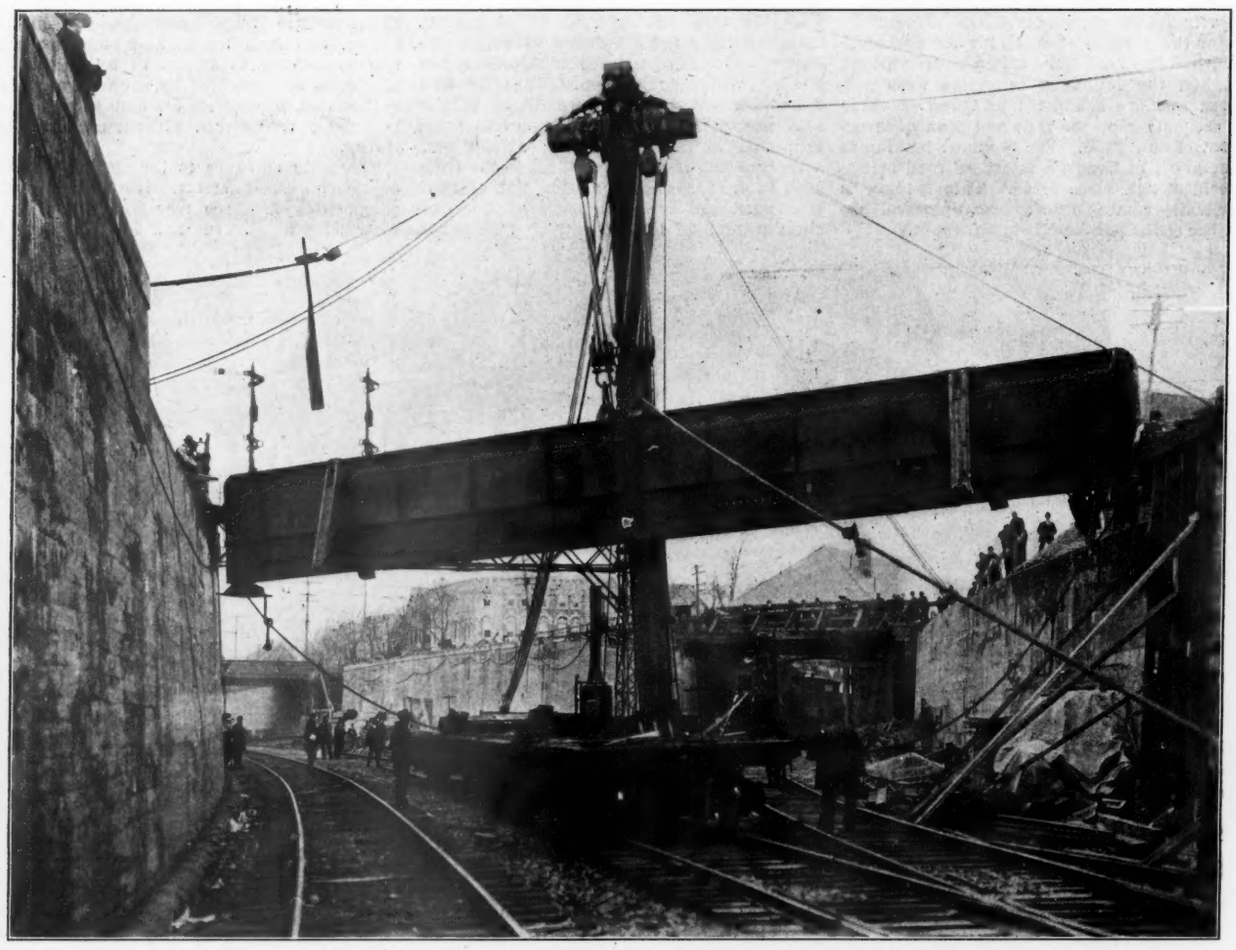
The plans have been so drawn that at any future time the capacity of the station can be doubled without in any way interfering with the architectural features or the general scheme. The accompanying illustration from the architects' drawing gives some idea of the size and magnificence of the proposed building.

Messrs. Warren & Wetmore, associated with Reed & Stem, are the architects for the station.

Erecting a Plate Girder Bridge With a Gin Pole.

BY J. W. PHILIPS.*

One of the most interesting engineering feats in connection with the Lackawanna improvements in Newark, N. J., which were described in the *Railroad Gazette* November 27, 1903, was the erection of the highway bridges over the depressed tracks in the western part of the city. The bridge which carries Roseville avenue over the tracks is a through plate girder bridge with floor beams and stringers, having concrete arches between the stringers which form the foundation for the asphalt roadway. Just east of Roseville avenue the Montclair Branch begins to turn north from the main line and under the bridge the main line is on a 2 deg. 30 min. curve to the left, and the branch line is on a 7 deg. 19 min. curve to the right. A single span was decided upon for the bridge at this point and this called for one girder 66 ft.



Erecting a 37-Ton Plate Girder with a Gin Pole at Newark, N. J.—Delaware, Lackawanna & Western.

*Assistant Engineer, D., L. & W.

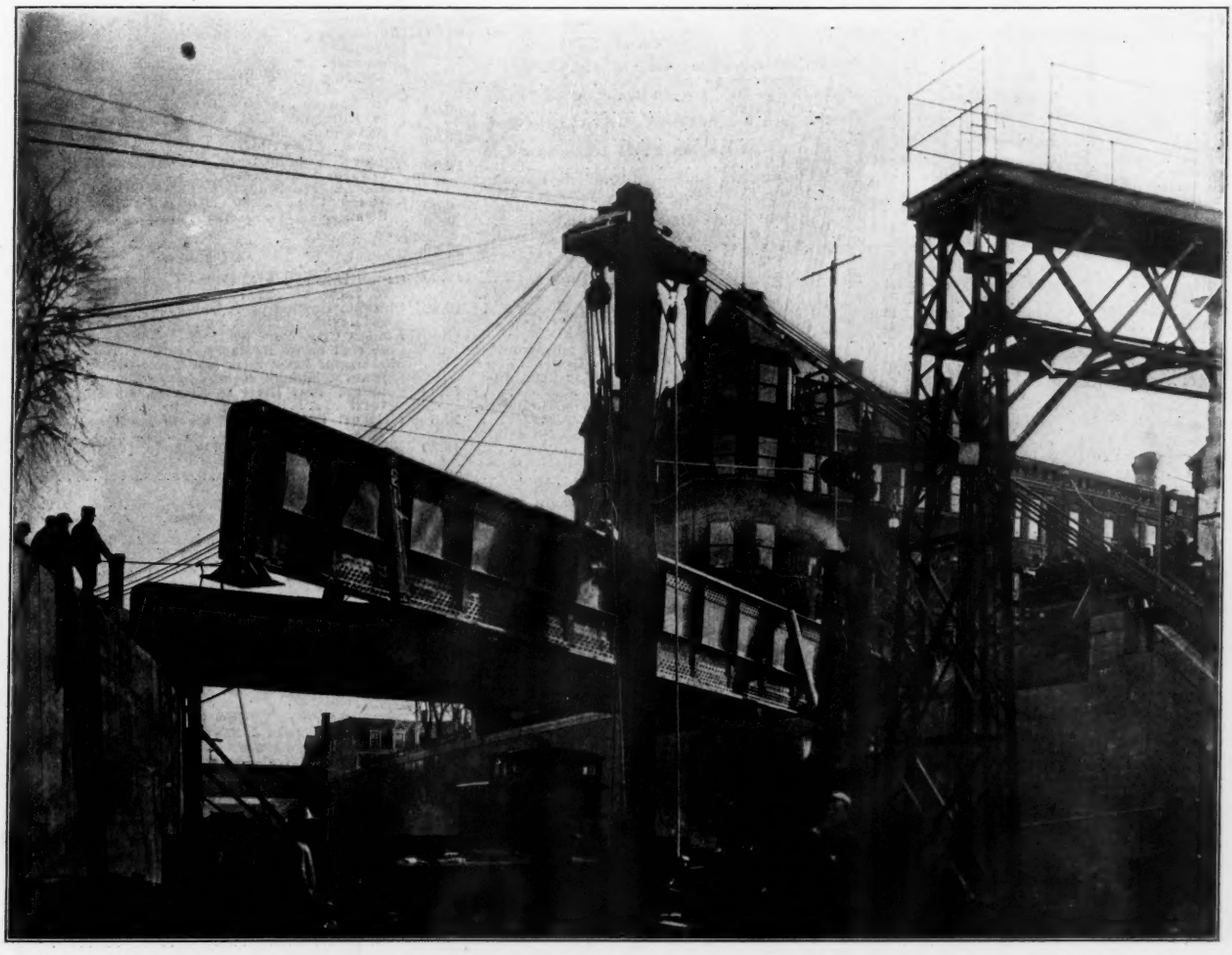
2 in. long weighing 28 tons for the east side, and one girder 76 ft. 11 in. long, weighing 37 tons, for the west side. The two girders are spaced 41 ft. center to center, leaving a clear width of roadway of 39 ft.

The tracks in the depression at Roseville avenue are 20 ft. below the crown of the roadway or street level, and as the girders were carried to the site on cars it was necessary to unload and to raise them to this height from the cars standing in the cut. To do this job, a gin pole was designed in the office of Mr. Lincoln Bush, Chief Engineer. It was made up of three sticks of yellow pine, 8 in. x 16 in. x 50 ft. long, giving a total cross-section of 16 in. x 24 in. The three sticks were securely bolted together and the pole was trussed on all four sides with 1¼ in. truss rods. A cross-arm 10 ft. long and projecting out on each side of the pole was attached on top and to this the lifting blocks were fastened.

In raising the girders an endless rope arrangement was used. One end of a 2-in. manilla rope was fastened to one of the winding drums of a 50-ton steam wrecking crane and the other end was fastened to one of the drums of a stationary hoisting engine provided for the purpose. This arrangement made it possible to pull on either end or on both ends simultaneously in raising the girder. Two sets of 35-ton, 3-sheave blocks were used with an extra set of single snatch blocks placed in between to equalize the load. The weight was taken from the girder to the blocks by means of clamps. Two 50-ton clamps weighing 500 lbs. each were fastened to each of the sets of 35-ton blocks and a smaller clamp weighing 150 lbs. was fastened to the snatch block. One set of 3-sheave blocks was also fastened from the top of the gin pole to an anchor west of the bridge so that the pole could be leaned in placing the girder in position. Five sets of guy lines were fastened to the top of the gin pole to keep it in an upright position.

In raising the east or shortest girder, the gin pole could not be placed nearer than 10 ft. from the center line of the final position of the girder on account of the junction of the Montclair Branch with the main line, and this girder was shifted about 10 ft. east after it was raised and placed on the abutments. This shift was made with jacks, the shoes being placed on rollers. The girder was placed on cars on the westbound main line beside the gin pole and the ends were pulled around in position by hand lines.

To raise the largest or west girder the pole was shifted to a position just west of the final position of this girder. The pole was moved to the new position by sliding it along, being kept upright by tightening and slackening off the guy lines. This girder was loaded on two extra long flat cars and the cars were placed on the westbound main line. An extra empty flat car was placed on the Montclair Branch track opposite the flat car on the main line standing farthest to the west. The west end of the girder was shifted by a 50-ton steam wrecking crane from the flat car on the main line to the car standing on the branch track. The empty flat car thus released on the main line was drilled out of the train and the girder was moved up near the gin pole by pulling one end up the Montclair Branch and the other end west on the main line. It was necessary to allow the ends of the girder to swing slightly on their bearings during this operation, but this was accomplished without any trouble. This girder was placed on an exact line east and west when it was lowered, but it had to be moved about two feet north to get it in its final position. This was accomplished by leaning the gin pole. It required 30 minutes to raise the small girder into position and 40 minutes to raise the large girder. The work was done between 11 a.m. and 12 noon, when traffic is very light, and but little delay to regular trains resulted from either operation. Two days elapsed between the raising of the first and second girders. These girders were raised and all the iron work on this improvement is being erected by a gang of journeymen iron workers employed by the Lackawanna Railroad under the direction of W. J. McNeely, General Foreman.



Erecting a 37-Ton Plate Girder with a Gin Pole at Newark, N. J.—Delaware, Lackawanna & Western.

It has been decided to double-track sections of the Siberian Railroad (not the whole road), and $5,000,000 has been appropriated therefor. The Ministry of War and the General in Chief have united in praising the admirable way in which the railroad has been worked and its capacity increased since the war began. When it opened the line could pass only four trains each way daily; now several times as many. Troops and supplies have been forwarded regularly and in sufficient quantities, and at the same time the work of construction vigorously prosecuted.

Railroad Built in 1904.

Table Showing Mileage Built in 1904, Classified by States.

	No. of Cos. building.	1904.	No. of Cos. building.	1903.
Alabama	5	110.64	4	129.39
Alaska	2	15	1	10
Arizona	1	59.66	3	107.07
Arkansas	9	142.43	14	230.77
California	11	191.3	8	169.55
Colorado	5	139.1	6	89.07
Florida	4	54.67	5	53.05
Georgia	7	119	11	133
Idaho	1	13.39	..	..
Illinois	7	162.78	6	114.3
Indiana	3	39	4	43.32
Indian Ter.	4	150.49	6	386.8
Iowa	2	29	5	229.2
Kansas	1	29	..	..
Kentucky	1	20	5	69.45
Louisiana	7	128.61	11	389.63
Maine	2	20	1	6.5
Maryland	1	15.8	2	12.82
Massachusetts	..	..	1	2.37
Michigan	5	21.7	13	158.68
Minnesota	2	221.49	6	262.1
Mississippi	7	267.93	6	116.4
Missouri	7	270.44	7	236.2
Montana	2	67.29	2	70.5
Nevada	2	176.50	1	20
New Jersey	2	7.64	1	4.84
New Mexico	2	10.62	2	158
New York	1	2	3	33.83
North Carolina	6	49.2	7	94.5
North Dakota	1	32.85	4	130.57
Ohio	5	83.3	9	134.19
Okla. Ter.	4	163.22	8	660.6
Oregon	1	23	3	21.75
Pennsylvania	15	195.85	16	286.37
Rhode Island	..	..	1	3.4
South Carolina	3	17.3	4	34
South Dakota	1	20	1	15.56
Tennessee	3	98.9	3	114.9
Texas	9	323.28	15	361.26
Utah	2	10	4	186.16
Vermont	..	..	1	5.25
Virginia	2	12.94	3	27.42
Washington	3	53.31	7	111.22
West Virginia	8	174.78	9	103
Wisconsin	5	81.85	6	125.48
Wyoming	1	7	..	..
Total, U. S.	172	3,832.26	235	5,652
Canada	7	316.39	11	687
Mexico	4	115.75	5	299

UNITED STATES.

ALABAMA.

Alabama Central—Booth to Autaugaville. 10.00
Alabama Northern—Pyriton to Ashland. 9.00
Atlanta & Birmingham Air Line (S. A. L.)—Coal City to Birmingham 38.00
Bay Minette & Fort Morgan—Bay Minette South. 10.00
Louisville & Nashville—Turkey C'k branch, Fedora to Indio, 2.95 miles; Hogeland branch, 0.65 mile; Graves branch, 2.62 miles; Boyle's Gap branch, 2.08 miles; Deming branch, 1.73 miles; total. 10.03
North Alabama (L. & N.)—Cain Creek branch 18.05
Oneonta & Attalla (L. & N.)—Altoona to Attalla 15.56
110.64

ALASKA.

Alaska Central—Not specified 10.00
Council City & Solomon River—From point 10 miles out of Dickson City to mile-post 15 ..... 5.00
15.00

ARIZONA.

Santa Fe, Prescott & Phoenix—Florence to Winkelman, 48.49 miles; Bradshaw Mountain branch, Saddle to Crown King, 6.17 miles; Arizona & California Junction to end of track, 5 miles; total..... 59.66

ARKANSAS.

Cache Valley—Sedgwick to Sach 7.00
Chicago, Rock Island & Pacific—De Valls Bluffs to Des Arc 13.80
Cotton Belt & Northern—Onalaska to Pritchard 3.50
De Queen & Eastern—From end of track towards Murfreesboro 21.00
Freeo Valley—Eagle Mills northeast 5.00
Mississippi, Arkansas & Western—Not Specified 8.00
Missouri Pacific—Eldorado to Louisiana and Arkansas State line, 5.37 miles; Cotter to Oregon Flat, 35.27 miles; McGehee to point north, 20 miles; Arkansas & Southwestern connection to point north 3 miles; total 63.64
Perla Northern—Perla to end of track.... 8.00
St. Louis & San Francisco—From point 4 miles out of Big Creek to Evadale..... 12.49
142.43

CALIFORNIA.

Boca & Loyalton—Beckwith to 6 miles west 6. miles; spur line, 2 miles; total..... 8.00
Butte County—Parker to Sterling City... 8.50
California Northwestern—Reclamation to Napa 10.00
Holton R. R.—Imperial to Holtville 15.00
Ione & Eastern—Ione towards Amador.... 12.00
McCloud River—McCloud to Barth 15.00
Oakland & East Side (At., T. & S. F. Coast Lines)—Richmond to Emeryville..... 11.47
Oregon & Eureka—Camp 13 to Big Lagoon 18.00
Placerville & Lake Tahoe—Placerville to Camino 8.00
San Francisco & Northwestern (A., T. & S. F.)—Camp 9 to Shively..... 2.30
San Pedro, Los Angeles & Salt Lake—From point 40 miles east of Daggett to California-Nevada State line..... 65.50
Southern Pacific—Imperial to Calexico, 12.71 miles; Simi tunnel to New Chatsworth, 4.82 miles; total 17.53
191.30

COLORADO.

Colorado & Northwestern—Sunset to Eldorado 20.00
Colorado Springs & Cripple Creek District Ry..... 1.10
Denver, Northwestern & Pacific—Arena to Arrowhead 59.00
Rio Grande R. R.—Pictou to Sunnyside Coal Mines 7.00
Uintah R. R.—Mack to Utah State line ... 52.00
139.10

FLORIDA.

Florida East Coast—Nomans to Homestead 18.00
Florida West Shore—Ellenton Junction to Ellenton 1.67
Natural Bridge R. R.—Moody to Wacissa.. 15.00
South Georgia & West Coast—Greenville to Perry 20.00
54.67

GEORGIA.

Atlanta & Birmingham Air Line (S. A. L.)—Howells to Rockmart 44.00
Darien & Western—Darien Junction to Liberty City 18.00
Dublin & Southwestern—Rentzville to Eastman. 17.00
Garbutt & Donovan Short Line—Lyons to Selma 14.00
Milltown Air Line—Milltown to Alapaha River, 3 miles; Milltown to Banks Mill, 3 miles; total 6.00
Tallulah Falls—Tiger to Clayton..... 3.00
Wadley & Mt. Vernon—Douglas to Willachoochee 17.00
119.00

IDAHO.

Northern Pacific—Thornton to Kootenai.. 13.39

ILLINOIS.

Chicago & Eastern Illinois—14 miles southwest Woodland Jct. to Villa Grove, 47.50 miles; completion of Findlay-Pana line 0.42 mile; total 47.92
Chicago, Burlington & Quincy—Fenton to Ebner 14.8
Cleveland, Cincinnati, Chicago & St. Louis—Hillsboro to Lenox..... 43.30
Elgin, Joliet & Eastern—Rockdale to Rockdale Junction 7.00
Illinois Central—Matthews to Sand Ridge 17.26
Illinois, Iowa & Minnesota—Aurora to De Kalb 28.00
Toluca, Marquette & Northern—McNabb Jct. north 4.50
162.78

INDIANA.

Cincinnati, Bluffton & Chicago—Pennville to Portland 10.00
Cleveland, Cincinnati, Chicago & St. Louis—Lawrenceburg Junction to Sunman, 18 miles; Greensburg to Gobbs Fork, 6 miles; total 24.00
Southern Indiana—Terre Haute north.... 5.00
39.00

INDIAN TERRITORY.

Choctaw, Oklahoma & Gulf (C., R. I. & P.).—From point 7 miles out of Haileyville to Wilburton 9.79
Midland Valley—Bokesha to Tulsa 125.00
Missouri, Kansas & Texas—Spur to M., K. & T. mines. 3.70
Muscogee Union—Muscogee to Corretta.. 12.00
150.49

IOWA.

Chicago, Anamosa & Northern—From Anamosa northwest 10.00
Newton & Northwestern—Gowrie to Rockwell City 19.00
29.00

KANSAS.

Kansas City, Mexico & Orient—Millton to Wichita 29.00

KENTUCKY.

Chesapeake & Ohio—Big Sandy branch, Elkhorn City to Prestonburg 20.00

LOUISIANA.

Donaldsonville & Napoleonville (T. & P.)—Donaldsonville to Napoleonville 15.70
Louisiana Railway & Navigation—Irene to Angola, 37 miles; Sarto to Naples, 7 miles; total 44.00
Missouri Pacific—Little Rock & Monroe connection to Farmersville 22.21
Monroe & Southwestern—Monroe towards Winnfield 15.00
Morgan's Louisiana & Texas—Raceland to Lockport 7.70
New Orleans, Natalbany & Natchez—Natalbany to Montpelier 16.00
Tremont & Gulf—Eros to Chatham 8.00
128.61

MAINE.

Eustis R. R.—From point on main line of Phillips & Rangeley to lumber section... 15.00
Somerset R. R.—Bingham towards Deadwater 5.00
20.00

MARYLAND.

Western Maryland—Big Pool to Hancock 9.70 miles; Wallbrook to Port Covington 6.10 miles; total 15.80

MICHIGAN.

Detroit & Mackinac—Last 3 miles into Cheboygan 3.00
Harbor Springs—Extension of Chrystal Springs branch 2.00
Manistique—Diller to Portage 6.00
Munising Ry.—Extension of East branch.. 2.50
Wisconsin & Michigan—Quinnesec to Cundy 1.20 miles; Nathan to the Menominee River, 7.00 miles; total 8.20
21.70

MINNESOTA.

Minneapolis, St. Paul & Sault Ste. Marie—Detroit City to Emerson 177.00
Minnesota & Great Northern (Great Northern)—Thief River Falls to Greenbush, 41.1 miles; Forest mine spur, 2.39 miles; Yates mine spur, 1 mile; total..... 44.49
221.49

MISSISSIPPI.

Gulf & Ship Island—2 miles north of Shines to Silver Creek 15.13
Illinois Central—Brookhaven to Monticello 40.00
Liberty-White R. R.—McComb to Liberty.. 24.00
Mississippi & Eastern—Quitman to the Alabama State line 20.00
Mobile, Jackson & Kansas City—Stringer to Newton, 39.50 miles; Ellisville Jct. to Ellisville, 6.50 miles; Ackerman to Naxapater, 36 miles; New Albany to Dewey, 51.50; total 133.50
Natchez, Columbia & Mobile—Booneville towards Pearl River 2.50
Yazoo & Mississippi Valley—Belzona to Yazoo City, 21.80 miles; Lambert to Swan Lake, 11.00 miles; total..... 32.80
267.93

MISSOURI.

Cape Girardeau & Chester—Cape Girardeau to Jackson 10.00
Chicago, Burlington & Quincy—Old Monroe to Mexico 63.00
Kansas City, Fort Scott & Memphis—Spur to coal mines in Bates County 3.56
Mississippi River & Bonne Terre—Hoffman branch, Bonne Terre to Hoffman, 7.4 miles; Flat River to Federal, 1.6 miles; total 9.00
Missouri Pacific—Carthage to point southeast of Galena..... 67.48
Missouri Southern—Ellington to Tralalon.. 15.00
St. Louis, Kansas City & Colorado—Stover to point near Leeds 102.40
270.44

MONTANA.

Great Northern—Whitefish to Rexford..... 59.85
Northern Pacific Bitter Root branch, Charlos to Darby. 7.44
67.29

NEVADA.

San Pedro, Los Angeles & Salt Lake—From 20 miles south of Caliente to 18 miles east of California-Nevada State line..... 115.50
Tonopah—Sodaville to Tonopah 61.00
176.50

NEW MEXICO.

Atchison, Topeka & Santa Fe—Extension of Hot Springs branch 0.62
Santa Fe Central—Moriarty towards mines 10.00
10.62

NEW JERSEY.

Central of New Jersey—West Second St. branch 0.64
Morristown & Erie—Whippany to Essex Fells 7.00
7.64

NEW YORK.

Lowville & Beaver River—Lowville to Illingsworth 2.00

NORTH CAROLINA.

Aberdeen & Rockfish—Rockfish to Hope Mills 7.00
Bee Tree—Swannanoa to Craggy Mountain 8.00
Durham & Charlotte—Little River to Troy 4.00
Norfolk & Southern—Mackey's Ferry to Plymouth 10.70
Pamlico, Oriental & Western—Newbern to Bayboro 17.50
Suffolk & Carolina—Norfolk & Southern Junction to Elizabeth City..... 2.00
49.20

NORTH DAKOTA.

Dakota & Great Northern (Great Northern)—Mohall to Sherwood, 14.85 miles; Edmore towards Munich, 18 miles; total.. 32.85

OHIO.

Cincinnati, Findlay & Fort Wayne (C., H. & D.)—Delphos to East Mandale..... 11.50
Lake Erie & Pittsburg—Lorain to Berea.. 13.00
Mahoning Valley Western—Niles to Newton Falls, 14.40 miles; Newton Falls to Ravenna, 13.70 miles; Ravenna to Cuyahoga Falls, 14.70; total 42.80
Newburgh & South Shore—Cleveland to Newburgh 7.00
Wheeling & Lake Erie—Adena branch, Maynard to point south of St. Clairsville.... 9.00
83.30

OKLAHOMA TERRITORY.

Arkansas Valley & Western (St. L. & S. F.)—Enid to Avard	58.47
Choctaw, Oklahoma & Gulf (C., R. I. & P.)—From 20 miles out of Chandler to Guthrie	10.45
Denver, Enid & Gulf—Enid to Coldwater	14.00
Missouri, Kansas & Texas—Oklahoma City to Ada	84.30
	163.22

OREGON.

Sumpter Valley—Sumpter to Tipton	23.00

PENNSYLVANIA.

Buffalo & Susquehanna—Driftwood to Sykesville	50.00
Buffalo, Rochester & Pittsburg—Parkwood to Ibella, 10 miles; Indiana to near Black Lick, 11 miles; Newcastle to Cement Works, 7 miles; total	28.00
Cherry Tree & Dixonville (N. Y. C. & H. R.) Cherry Tree to Possum Glory Jct.	21.00
Clearfield Southern (N. Y. C. & H. R.)—From point 4 miles from Potts Run to Irvona	12.30
Curwensville & Bower—Lumber City to Curwensville	11.60
Hickory Valley—Delight to Queen	2.00
Huntington & Broad Top Mountain—Kimber Run branch	1.00
Lehigh & New England—Bath Junction to Bath Port	1.50
Mt. Jewett, Kinzua & Riterville,	3.15
Pennsylvania—Brilliant branch, 10 miles; not specified, 23 miles; total	33.00
Pennsylvania Lines West—Burgettstown to mines, 1.7 miles; Meadowlands to mines, 1.72 miles; Burgettstown to mines, 4.25 miles; total	7.67
Philadelphia & Reading	1,63
Pittsburg, Summerville & Clarion—Summerville to Carion, 15.5 miles; Strattonville, to Mill Creek, 3.5 miles; total	19.00
Pittsburg, Westmoreland & Somerset—Ligonier towards Somerset	1.00
Susquehanna & New York—Hillsgrove Junction to Hillsgrove	2.00
Williamsport & North Branch—Birch Creek Junction to Bernice	1.00
	195.85

SOUTH CAROLINA.

Alcolu R. R.—Hudsons to Beulah	4.00
Pickens R. R.—Pickens to Easley	9.30
Ware Shoals—Barmore to Ware Shoals	4.00
	17.30

SOUTH DAKOTA.

South Dakota Central—Sioux Falls to Colton	20.00

TENNESSEE.

Chattanooga & Montlake—Montlake to coal mines	2.00
Knoxville, La Follette & Jellico—Remainder of line between Knoxville and Saxton not reported in 1903, 63.1 miles; Cow Creek branch, 13 miles; Clear Fork branch, 6.1 miles; Hog Camp branch, 2.9 miles; spurs, 4.3 miles; total	89.40
Nashville, Chattanooga & St. Louis—From point 3 miles out of Coalmont to Coalmont, 3 miles; line to Eastland, 4.5 miles; total	7.50
	98.90

TEXAS.

Livingston & Southeastern—Livingston to Knoxville	7.00
Missouri, Kansas & Texas—Austin division, Georgetown to Austin	30.00
Nacogdoches & Southeastern—Nacogdoches to Woden	10.50
St. Louis, Brownsville & Mexico—Harlingen to Fordyce, 56.00 miles; Point 20 miles from Robstown to Brownsville, 121.25 miles; total	177.25
St. Louis Southwestern of Texas—Monterey to end of track	4.33
San Antonio & Aransas Pass—Alice to Falfurrias	36.00
Texas & Gulf—Timpson to end of line	15.00
Trinity & Brazos Valley—Remainder of line between Cleburne and Mexia	21.00
Wichita Falls & Oklahoma—Wichita Falls to Byers	22.20
	323.28

UTAH.

San Pedro, Los Angeles & Salt Lake—Near Frisco to Newhouse	7.00
Uintah R.R.—Colorado State line to Dragon	3.00
	10.00

VIRGINIA.

Louisville & Nashville—Mile-post 198 from Louisville to coal property of Bell Jellico Coal Co., 1 mile; Pennington Gap branch Pennington towards coal lands, 3 miles; total	4.00
Norfolk & Western—Roanoke Belt line, 2.34 miles; Blair to Galax, 3 miles; Radford branch, 3.6 miles; total	8.94
	12.94

WASHINGTON.

Northern Pacific—Peninsula branch, mile-post 22 to Moclips, 5.9 miles; Woodinville to Renton, 16.07 miles; new lines in Seattle, Wash, 1.04 miles; total	23.01
Tacoma Eastern—Nisyually canyon to Ashford	16.30
Washington & Great Northern—Curlew to Midway	14.00
	53.31

WEST VIRGINIA.

Chesapeake & Ohio—Raleigh to end of track, 10.6 miles; Thurmond to mines, 4.1 miles; Piney Creek to end of track, 0.8 mile; Durbin to Bartow, 2.2 miles; total	17.70
Coal & Coke—Otter to Gassaway	28.20
Deepwater—Robson to Open Fork	10.00
Imboden & Odell—Blue Creek to Tunnel No. 2	10.00
Kanawha, Glen Jean & Western—Thurmond to Kilsyth	4.00
Morgantown & Kingwood—Bretz to Reedsville	2.50
Norfolk & Western—Kenova to Naugatuck, 59.12 miles; Iaeger to Ritter, 4.9 miles; Widemouth branch and Spurs from Montcalm down Bluestone River, 19.13 miles; Tug Fork branch extension above Gary, 5.3 miles; Zenith branch extension into McDowell County, 1.33 miles; total	89.78
Point Pleasant, Buckhannon & Tyarts Valley (B. & O.)—Lemley Junction to Buckhannon	12.60
	174.78

WISCONSIN.

Chicago, St. Paul, Minneapolis & Omaha—Radisson to Winter	10.00
La Crosse & Southeastern—Viroque to Stoddard	18.00
Mineral Point & Northern—Mineral Point to Highland	26.00
Minneapolis, St. Paul & Sault Ste. Marie—Birchwood to Reserve	18.85
Stanley, Merrill & Phillips—Hannibal to Jump River	9.00
	81.85

WYOMING.

Laramie, Hahn's Peak & Pacific—Laramie west	7.00

CANADA.

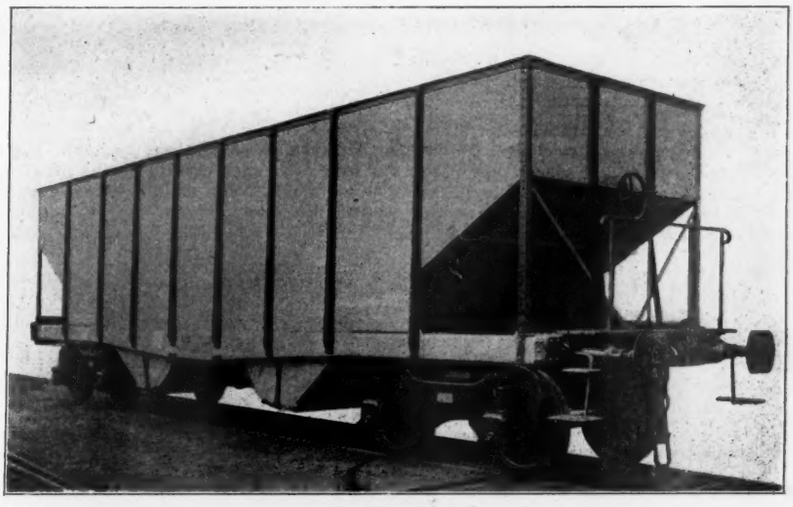
Algoma Central & Hudson Bay—Mekatina branch, mile-post 64 to mile-post 66	2.00
Canadian Northern—St. Charles to Somerset, 77.00 miles; Emerson line, 22.00 miles; Rossburn Jct. towards Rossburn, 80.00; total	179.00
Canadian Pacific—Esterhazy to Lipton	84.00
Crow's Nest Southern (Great Northern)—Swinton, B. C., to Fernie	9.82
Galt, Preston & Hespeler—Berlin to Waterloo	2.00
Orford Mountain—Eastman, Que., to Potton Springs, 12.00 miles; Kingsbury, Que., towards Winsor, 2.00 miles; total	14.00
Quebec & Lake St. John—St. Gabriel towards Gosford	4.00
Vancouver, Victoria & Eastern Railway & Navigation (Great Northern)—Grand Forks, B. C., to Granby Smelter, 4.57 miles; Grand Forks to Phoenix, 17 miles; total	21.57
	316.39

MEXICO.

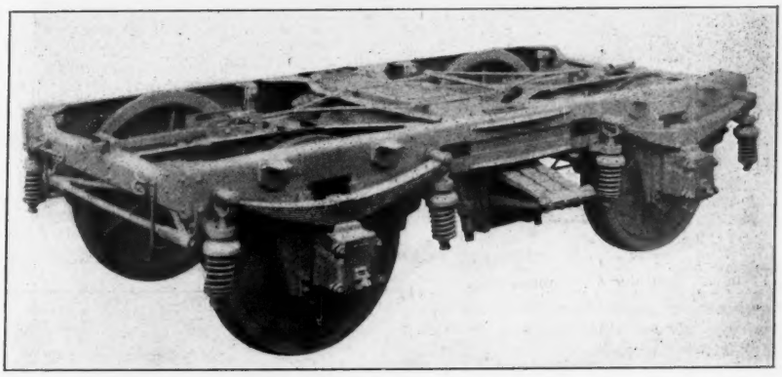
Mexican Central—Remainder of line between San Pedro and Paredon	43.00
Mexican International—Mezquite to Carbon	3.75
Nacozari—Cos to Nacozari	20.00
National of Mexico—From San Juan east towards San Miguel, 20 miles; Salamanca to Gonzalez, 29 miles; total	49.00
	115.75

Fifty-ton Cars in France.

The Douai Iron Works has recently built a number of 50-ton pressed steel cars for mineral traffic which have an exceptionally light tare weight. The hopper cars, one of which is shown in one of the illustrations,



50-Ton Pressed Steel Hopper Coal Car for the Carmaux Mines.



Arbel Pressed Steel Truck, Douai Iron Works.

were built under the Fox-Arbel patents with pressed steel fish-bellied sills and double hopper doors discharging toward the center of the car. They are mounted on Fox pressed steel trucks and will be used in the coal traffic from the Carmaux mines. The body is 34 ft. 9¼ in. long inside and 8 ft. 7½ in. wide inside, and has a cubic capacity, with the load heaped to 50 deg., of 2,048 cu. ft. The maximum load which can be carried is 110,000 lbs., and the tare weight is 34,300 lbs., giving a ratio of dead load to paying load of 1:3.2. The truck journals are 5½ in. x 9¾ in., or slightly smaller than those used in the United States for cars of equal capacity.

Another type of 50-ton car which has also been built is a gondola with two doors in each side. Like the hopper cars, these cars are entirely of pressed steel, but they are

mounted on Arbel trucks with half-elliptic springs hung over each box on the outside of the frame. They were built for the Southern Railway of France and are in use between the ore mines of the Pyrenees and Cette, carrying iron ore to the Creusot Steel Works. The cars are 34 ft. 9½ in. long, 3 ft. 3¼ in. high, and 8 ft. 7½ in. wide, inside measurements. This gives a cubic capacity with a flush load of 996 cu. ft. so that 33 tons of coal, or 55 tons of ore, can be carried. The tare weight is 33,880 lbs., and the ratio of dead load to paying load is 1:3.24. One of these cars was tested with a load of 90 tons without showing any permanent set or other damage.

The Douai Iron Works is now installing some new presses for forming pressed steel sills up to 65 ft. long and expects to build in the future cars of even larger size and capacity than those which have just been turned out.

Passenger Stations on the Grand Rapids & Indiana.

A few weeks ago we printed descriptions of some passenger stations of the Duluth, South Shore & Atlantic (Nov. 25, page 583). These stations had been favorably commented on in the report of the Railroad Improvement Committee of the American Park and Outdoor Art Association at the St. Louis convention. Some other stations receiving equally favorable mention were a number recently built by the Grand Rapids & Indiana. With one exception—the Union Station at Grand Rapids—these are small city stations, the accompanying views, plans and descriptive notes of which were sent by courtesy of Mr. W. B. Stimson, Superintendent at Grand Rapids. This road, in replacing its old buildings, has not only sought to plan the interiors to subserve best the public's as well as its own interests, but with a view of presenting a pleasing and attractive exterior. Special attention was given to beautifying the grounds, the work having been planned and executed by an experienced landscape architect.

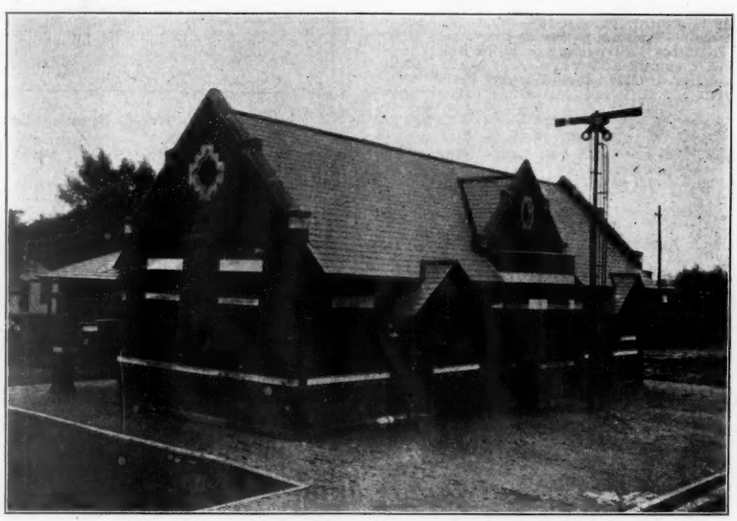
Station at Petoskey, Mich.

The station at Grand Rapids was completed in December, 1900. It is of brick and terra cotta with a slate roof. The building is 323 ft. long, 56 ft. wide and two stories high, with a central clock tower. Covered ways extend over the sidewalk at the front, and in the rear connect the station with the train-shed. At the south end is a covered carriage stand separating the main building from the annex containing the mail and express rooms. The main waiting room is 80.6 ft. by 54.6 ft., and is two stories high. The interior arrangement is shown by the floor plan. The main waiting room is in the center, its sides being flanked by the women's retiring room, smoking, dining, lunch, parcel and news rooms, barber shop, baggage room and telegraph and ticket offices. The interior walls for two-thirds of their height are wainscoted with Tiffany white enamel brick, above which a yellow decorative brick is used. The ceiling is of plaster and stucco. The second story is fitted up for offices, and reading and bath rooms for the use of employees. The train-shed is a "through" shed, erected in 1890, having steel columns with arch trusses supporting a slate roof. It is 600 ft. long by 137½ ft. wide, containing seven tracks. Large and attractive lawns have been laid out north and south of the station building.

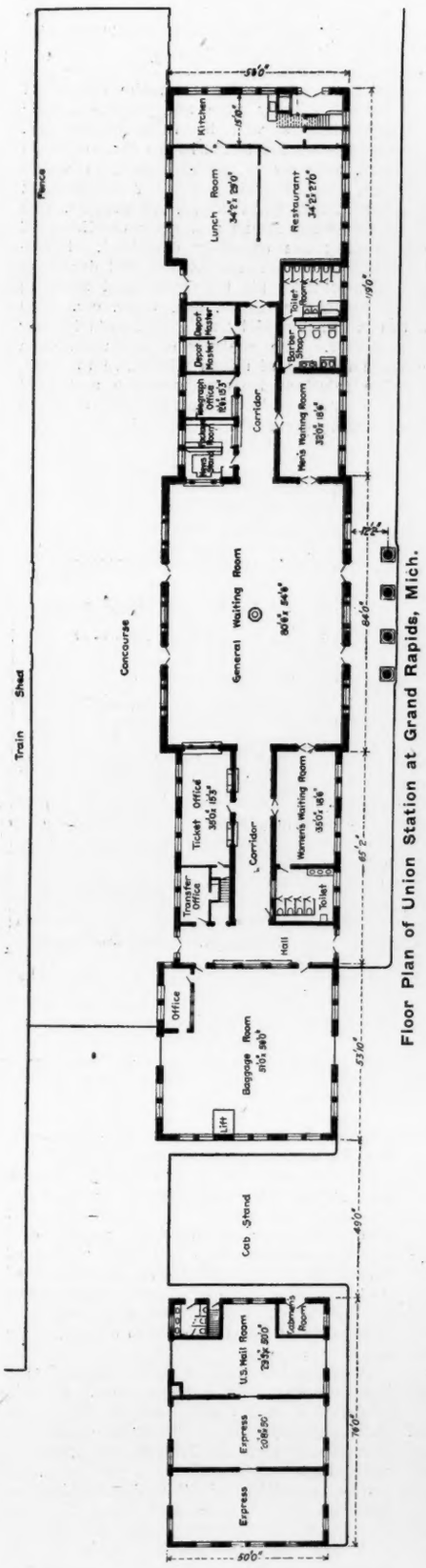
Station at La Grange, Ind.

The Cadillac station, built in 1900, is of brick with brown stone trimmings and a slate roof. A floor plan shows the interior arrangement with separate men's and women's waiting rooms, a rest room for women, smoking room for men, dining room, and the ticket and telegraph office and baggage room conveniently located. All of the interior walls have a 5-ft. wainscoting of white enamel brick, and the floors are mosaic tile except the baggage room, which is maple. In the second story there are reading, rest and bath rooms for employees.

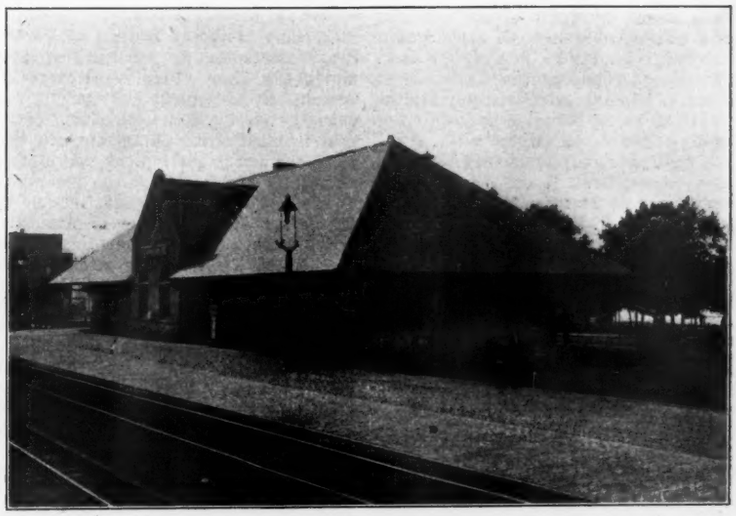
Petoskey has an attractive little station



Station at Decatur, Ind.

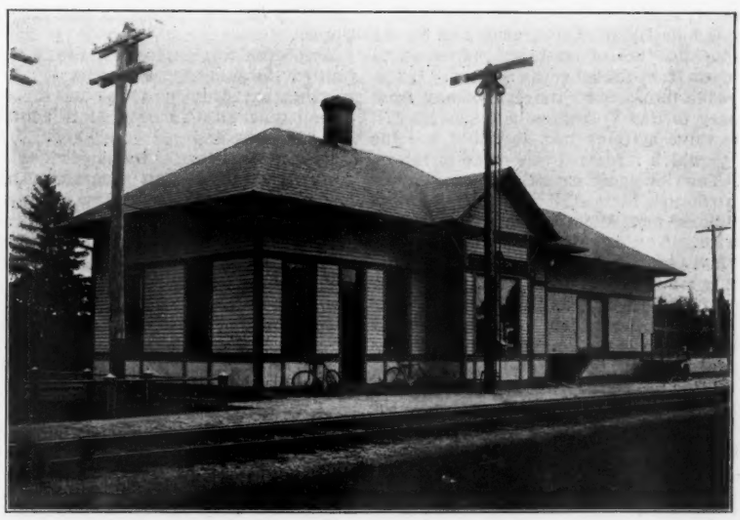


Floor Plan of Union Station at Grand Rapids, Mich.



Exterior of Station at Cadillac, Mich.

Interior of Union Station at Grand Rapids, Mich.



Frame Station at Mendon, Mich.

of brick with stone trimmings and slate roof. Extending along the front of the building and for a considerable distance beyond each end, adjacent to the tracks, is a canopy shed. The platform surrounding the station is of paving brick. On the interior, the main, or men's waiting room, occupies the center of the building and is 50 ft. by 30 ft. The women's waiting room, 20 ft. x 20 ft., and the toilet rooms, flank it on one side, and the baggage room, 24 ft. x 30 ft., with the telegraph office, 6 ft. x 12 ft., in one corner, on the other. The ticket office is on the opposite side of the main waiting room from the tracks. The waiting rooms are finished with tutti calori floors, high ivory enamel brick wainscots, and plaster walls and ceilings.

One block south of this building is the suburban station, a frame structure used during the summer in handling the heavy suburban travel between Petoskey and Harbor Springs, and the resorts along Little Traverse Bay, Oden and Walloon Lakes. The company has laid out and beautified with trees, flower beds, and walks, parks extending south two blocks from its station along the west side of its tracks, and on the opposite side of its track extending south one block from its suburban station. It has also made into a lawn its right-of-way from Petoskey to Bay View (one mile).

The three stations just described are the ones to which reference was made in the report. The views sent us include several neat and attractive little stations at small towns in Indiana and Michigan, and are shown herewith. The Decatur, Ind., station was built last year. It is red brick with Bedford stone trimmings and slate roof. The interior has a maple floor and yellow pine wainscoting except the women's sitting room and the smoking and toilet rooms, which have tile floors and enamel tile wainscoting. The station at La Grange, Ind., was built in 1901. It is frame, with shingle roof, and the interior is ceiled with yellow pine, except the toilet rooms, which have a cement wainscot. All of the floors are cement. The Mendon, Mich., station is for freight and passenger service, and was built about three years ago. The interior is ceiled with light-colored wood.

The Strength of Structural Timber.

Circular 32 of the Bureau of Forestry of the Department of Agriculture is issued under the title "Progress Report on the Strength of Structural Timber." It was prepared by Dr. W. Kendrick Hatt, Civil Engineer in the Bureau of Forestry, in response to a demand from lumber operators, engineers and architects for the partial results of the tests now being carried on by the bureau to determine the mechanical properties of the various commercial timbers of the United States. The circular contains, among other things, the results of cross-bending tests on about 250 large beams of structural timber. A more formal publication is to be issued later, giving a detailed account of methods and machines used to obtain the results, tabulating the individual tests and analyzing thoroughly the results. The data already on hand will allow the formulation of certain relations between the knots and strength, and between the rate of growth and strength, and will form the basis for an intelligent revision of the present rules for the inspection and grading of timber.

According to the circular, the bureau has limited its present programme (1) to those species that promise to be on the market for an indefinite period; (2) to actual market products, and (3) to such purely scientific work as forms the basis for correct methods of test. The programme also includes tests to determine the effect of artificial seasoning, such as is used in the operations preliminary to the preserving processes, and the effect of the presence of the preservatives themselves. One object of the tests is to aid in the framing of definite inspection rules for the various grades of structural timber.

Following is the programme of the work as at present planned:

Tests to determine properties of structural timber:
- Series I. Tests of the mechanical and physical properties of timber in forms found on the market. The material will be of actual sizes and grades of commercial products. The purpose is to determine moduli for design; to determine the value of woods now considered inferior, to determine the liability to knots, and the reducing factors due to these; to arrange a table of standard weights, and rules for inspection and grading; and partly to compare the properties of species from different regions.

Tests to determine the effect of variations in conditions:
- Series II. Effect of rate of application of load, including impact tests.
- Series III. Effect of moisture.

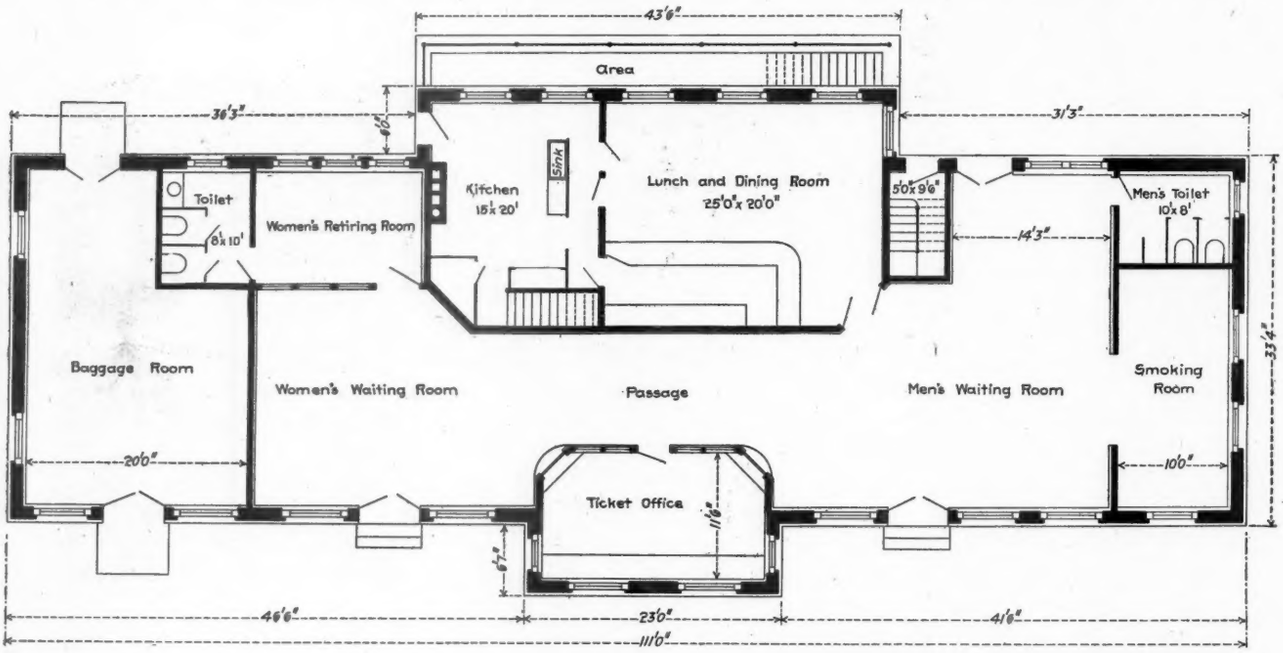
Studies of the effect of technological processes:
- Series IV. Preservatives.
- Series V. Methods of seasoning.
- Series VI. Fire retardants.

In Series I, for instance, the structural value of loblolly pine and of the Pacific Coast timbers will be fully determined. These species are tested in the form of large sticks, such as bridge stringers, in which knots, crooked grain and other defects that occur in structural sticks, are present. The origin of the sticks and their condition of seasoning are carefully described. Photographs of the stick are taken and drawings made, locating all the knots and showing the amount of heart, sap, wane, etc. The sticks are graded by an experienced lumber inspector. The analysis of the tests of a large number of sticks will serve to determine relations between strength and kind and number of knots, and between strength and rate of growth.

In an investigation of a wood like red gum (*Liquidambar styraciflua*) the tests include not only building material, such as floor joists, but also an examination of the merits of the wood in the form of small clear stock, such as is used for carriage construction, implements, etc. The ability of the wood to withstand the operations of steaming and bending is also investigated. In the case of this timber, the tests have been made on specimens taken directly from the forest.

It is the intention to test structural timber generally in the green state. Certain sticks will be set aside for the length of time necessary for a thorough drying, in order to develop the defects arising during seasoning.

The question of the distribution of moisture in the large sticks and the relative strength of green lumber and lumber that has been only partially dried on the surface will be taken up. It is apparent that lumber dealers do not keep large sticks on hand long enough to allow them to dry out thoroughly, and it does not seem at the present time that the surface dryness in-



Floor Plan of Grand Rapids & Indiana Station at Cadillac, Mich.

creases the strength of these large sticks in any marked degree.

The species under investigation at the present time are: The Pacific Coast red fir (*Pseudotsuga taxifolia*), otherwise called Oregon pine or Douglas spruce; the western hemlock (*Tsuga heterophylla*); the red gum (*Liquidambar styraciflua*); the longleaf pine (*Pinus palustris*); and the loblolly pine (*Pinus taeda*). Later on, the redwood (*Sequoia sempervirens*) and western yellow pine (*Pinus ponderosa*) will be tested.

Tests of the loblolly and longleaf pines, of red fir and of western hemlock are given in considerable detail in the circular. The localities in which the timbers are found, their characteristics, uses to which adapted, etc., are described, and there are a number of tables giving the results of tests on different specimens of each variety. It will be possible only to indicate a few of these results here.

Sticks of green Virginia loblolly pine 8 in. x 8 in. were tested about a month after cutting, developing a modulus of rupture of 3,281 lbs. per sq. in., a modulus of elasticity of 729,000 lbs. per sq. in., the dry weight per cubic foot being 26.3 lbs. Some air-dried sticks—8 in. x 8 in., dried two years; 4 in. x 8 in., dried one year—show higher figures. The former was: modulus of rupture 4,874 lbs., modulus of elasticity 1,164,000 lbs., dry weight per cubic foot, 28.8 lbs. The 4 in. x 8 in. was of denser structure and slower growth. The modulus of rupture was 6,319 lbs., modulus of elasticity, 1,219,000 lbs., and dry weight per cubic foot, 29.4 lbs. Part of the 4 in. x 8 in. stuff was soaked to bring it to the green state, in order to obtain the relations between air-dry and green timber. The moisture was increased from 19.4 per cent. to 46.3 per cent. The modulus of rupture of the soaked timber was decreased about 20 per cent., and the modulus of elasticity about 2 per cent.

The distribution of moisture in some 8 in. x 14 in. North Carolina sticks was determined by sawing out a section 1 in. thick halfway between the ends, dividing it into nine parts by cutting lengthwise and crosswise at the quarter points, and determining the moisture in the several parts. The average shown by a diagram presented is 31.7 per cent., with 39.6 per cent. in the center section and an average of 29.9 per cent. in the four corner sections.

In regard to longleaf pine, it is stated that its tendency to check upon drying out and to fail by longitudinal shear was very noticeable in the tests. This is one reason for the belief that the engineer is not justified in using unit stresses larger than those obtained by tests upon green timber. The modulus of rupture of the Georgia longleaf was 8,384 lbs., the modulus of elasticity 1,820,000 lbs., and the dry weight per cubic foot, 42.9 lbs.

In the case of both longleaf and loblolly pine, small sticks were sawed from the uninjured portion of the large sticks after testing. Further tests were made on these small sticks to determine the relation between the strength of the large and the small sticks, the relative strength of pieces of various rates of growth, and the effect of moisture when the variations due to knots and defects were eliminated. These minor tests were also made on sticks cut from red fir and western hemlock, as noted below. One of the tables shows a comparison of these tests on the smaller sticks sawed from the larger sticks with the tests on the large sticks. It appears from this table that the modulus of rupture of small clear sticks 2 in. x 2 in. in cross section is on an average about 30 per cent. higher than that of the sticks from which they were cut. This increase varies from 100 per cent. to 2 per cent. The modulus of elasticity, however, of small beams is only 92 per cent. of that of the large beams. These values are based on a comparison of the average results of tests of sticks of various grades. Of course, the small clear sticks are relatively stronger than the parent sticks when the latter are of second grade—that is, contain large knots.

The red fir of the Pacific Coast is declared to be an ideal structural timber because of the possibility of procuring long and large pieces, combined with the exceptional strength and stiffness of the material compared with its weight. Being almost entirely heartwood, the red fir is durable on exposure to the weather. It is evident from the tabular results that red fir is of varied quality, and that specifications need to be drawn somewhat more carefully than in the case of longleaf pine to exclude the wider-ringed quick growth and knotty sticks. Certain sticks 6 in. x 8 in. and 8 in. x 16 in. are taken as representing an average quality of red fir, and including select, merchantable, and seconds, it appears that the modulus of rupture is 7,790 lbs. per sq. in., the modulus of elasticity 1,783,000 lbs. per sq. in., and the dry weight per cubic foot 28.5 lbs. The average rate of growth was nearly 19 rings per inch; that is to say, the tree added 1 in. to its radius, or 2 in. to its diameter, in 19 years. It does not appear from the results of the tests that there is any marked difference in the strength of fir of red and yellow color, provided the sticks have the same rate of growth and are equally free from defects. A series of tests on small clear sticks of straight grain indicates that a rate of growth corresponding to 21 rings per inch yields the greatest density and strength.

These red fir sticks were tested from six months to one year from the time of sawing. They were kept in a shed and sprinkled to prevent dying out. The exterior parts of the beams contained less moisture than the center, but the difference was not marked. An examination of the distribution of the moisture throughout the cross-section of six 8 in. x 16 in. beams showed an average of 23.9 per cent., the relations being shown by a diagram, as with the pine.

Western hemlock, as such, has no market standing, but large quantities of the timber are cut and sold under such names as Alaska pine, Washington pine spruce, or fir. There is a strong prejudice against the name of hemlock, which is merited only by the eastern species. The wood of the mature western hemlock is hard, straight and even-grained. It does not split readily and is light to the touch, making it especially suitable for box manufacture. For flooring, molding, paneling and all inside finish it makes a superior lumber, not easily scratched, susceptible of a high polish, and of excellent wearing qualities. The average of results so far obtained, though incomplete, shows a modulus of rupture of 5,530 lbs., a modulus of elasticity of 1,261,000 lbs., and a dry weight per cubic foot of 26.8 lbs.

Some discussion of the results of the tests in general is next given, including a summary of the first table showing the cross-bending strength of structural timber. Other results briefly discussed are: Strength and compression, longitudinal shear, and shearing strength.

One of the tables gives the results of tests of red gum (also known as sweet gum and star-leaved gum). These tests were on 4 in. x 4 in. sticks only, and included cross-bending and compression parallel to the fiber. Further tests were to be made and an analysis of the results will attempt a determination of the relative strength of the fiber throughout the height of the tree, and of the relative strength from the heart center to the bark. The specimens tested were of two kinds, namely, green and partially kiln-dried. For the former the test pieces were kept at the moisture of green timber by a cover of sacking, which was sprinkled day by day. Each test piece was put in a moist closet for two days preceding the actual test. As timber has to dry to a degree of moisture below 33 per cent. before any subsequent drying begins to affect the strength of the fiber, and the average moisture of these green specimens was 86.4 per cent., the values given are those for green timber. The partially kiln-dried material was the result of an attempt to dry some of these 4 in. x 4 in. gum sticks in a kiln without subsequent air drying. The kiln drying consisted of the following operations: The sticks were steamed for 48 hours with live steam, producing a temperature in the kiln of 110 deg. to 125 deg. F. The steam was then shut off, and the kiln heated for 35 days to a temperature varying from 85 deg. F. on the first few days to 150 deg. and 160 deg. F. at the last. Checking and twisting were most noticeable during the first four or five days in the kiln, after which no large increase was observed. It was noticed upon removal from the kiln that the surfaces of all the timber were apparently dry, having the convex surface peculiar to kiln-dried timber. Upon cutting into the pieces it was found that the heartwood had dried only to a depth of ¾ in. The sapwood had dried from a depth of 1¼ in. to thorough dryness. Subsequent kiln-drying tests on 2 in. x 2 in. red gum heartwood stock have shown satisfactory results. In the latter case a much slower anl drier heat was given the specimens, which were afterwards steamed and bent into the carriage-wood stock.

To determine the effect of close piling on green wood, 34 specimens of heartwood and 22 specimens of sapwood were close-piled in a green condition in the laboratory and allowed to remain for six months, developing sap-stain and fungus growth. These specimens were afterwards tested. The results of the tests on this "blued" (sap-stained) timber are compared in a table with the results of the tests given in the table mentioned in the preceding paragraph. As has been shown in previous tests with pine, both in Germany and in the United States, the effect of this "bluing" is not detrimental to the strength of the timber.

Another series of tests, recorded in tabular form, compares hickory and red gum, the tests being made in order to determine if red gum had the mechanical properties which would fit it for use in the vehicle industry. An appendix to the report contains some notes on Table I, rules for inspection and grading, and a detailed description of the various beams tested.

The Panama Canal—Mr. Wallace's Plans.

John F. Wallace, Chief Engineer of the Panama Canal, recently made a report of some length to the House Committee on Interstate and Foreign Commerce, in which he discussed the general situation and also outlined the several plans now under consideration, taking up more fully some of the matters touched on in his Chicago speech, last September (*Railroad Gazette*, Oct. 7, 1904). The following extract is taken from an Associated Press despatch in the New York *Tribune*.

The isthmus is traversed by a mountain range, the summit of which is approximately 12 miles from the Pacific and 35 miles from the Caribbean. Originally a gorge evidently existed from the Caribbean near Colon to

near Gamboa, and extended beyond that point in an easterly direction, forming the upper basin of the Chagres River. After filling this gorge with an alluvial deposit, the Chagres has swung itself from one side of the valley to the other. The result is that the thread of the original gorge cannot be followed or found from surface indications, and it is only by drilling to bedrock that exact information in regard to any particular locality can be obtained. The presence of boulders in this alluvial deposit also explains the reason why engineers not taking time to go into the rock far enough to determine its actual character have been misled into thinking they had struck bedrock. To determine the most feasible plan for the construction of the canal will require a most careful and comprehensive examination not only of surface conditions, but of the subsurface.

After following the valley of the Chagres to Gamboa, the line of the canal follows a tributary, called the Obispo, up to the summit of Culebra, and thence down the valley of the Rio Grande into the Bay of Panama. The summit at Culebra was originally about 300 ft. above the sea level, and is the lowest point in the divide along the entire length of the Isthmus of Panama. The plan of the former commission provided for a dam of practically 100 ft. in height, above sea level, at Bohio, with a water level of 90 ft. above sea level. This place was selected on account of the fact that at that point the hills on either side of the Chagres come comparatively close together, being about 1,500 ft. apart, and from the surface indications it seemed a favorable place to build a dam. But the indications are that this locality will be an unfavorable and expensive one for the construction of a high dam.

Four Plans Considered.

The first plan to be considered, the one estimated upon by the former commission, is the possibility and practicability of a high dam, or proper foundation for a high dam at Bohio, on which depends the advisability of constructing a high level canal, with the surface of the water 90 ft. above sea level.

The second plan under consideration is a summit level of 60 ft. above sea level. Constructing a canal on this plan admits of two different methods of treatment. First, by building a dam 60 ft. above sea level, at Bohio, with two locks of 30 ft., there being two locks on the western slope; second, by building a dam 60 ft. above sea level, at Gatun, eight miles from Colon, with two 30-ft. locks in the same neighborhood. The adoption of a 60-ft. level also will render it necessary to build a dam at Gamboa, in order to provide a reservoir to accumulate water enough in the wet season to furnish water for the summit level of the canal. A dam at Gamboa, in connection with this, would also control the Chagres River, except that it would be necessary to provide a safety spillway by the construction of a tunnel some eight miles in length through the divide, discharging the surplus waters of the Chagres into the headwaters of the Juan Diaz, or the alternative plan of constructing a tunnel four miles long through the divide, separating the Chagres basin from the headwaters of the Gatuncillo, a stream which enters into the Chagres Valley at Batun. Should this latter course be adopted, it would be necessary to construct an auxiliary channel for the Chagres from Gatun to the sea, in order to divert its flood waters into the bay eastward of Colon.

The third general plan under consideration would be the construction of a canal, with a 20-ft. or 30-ft. level, above the sea, with a single lock at Miraflores and a single lock at Bohio, or in the immediate neighborhood; the construction of the Gamboa dam to be required in this instance the same as in the 60-ft. level plan.

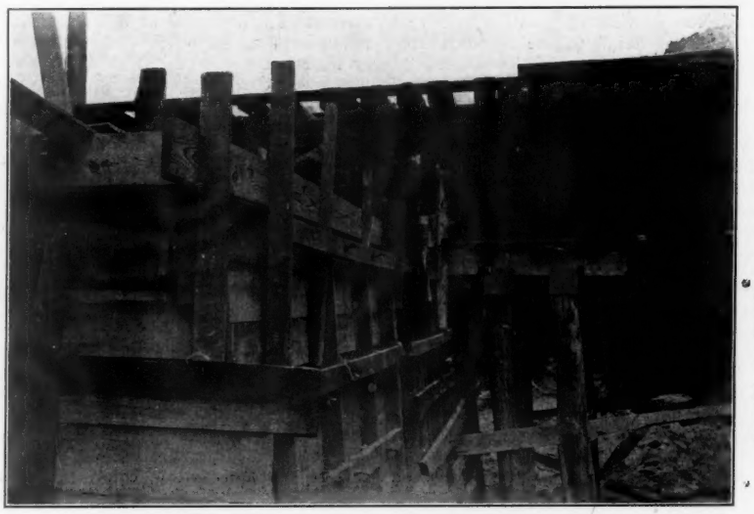
The fourth plan would be the construction of a sea level canal, with a tidal lock, at Miraflores. In this connection it is necessary to explain that, while the mean sea level of the Pacific and the Caribbean is the same, high tide in the Bay of Panama rises 10 ft. above mean sea level and falls 10 ft. below; whereas the fluctuation of the tide of the Caribbean at Colon is less than two feet. The construction of a dam at Gamboa, with the necessary spillways, as noted in the previous plan, would be the same under the sea level plan as under the 30 or 60-ft. level.

The construction of the Gamboa dam would provide the water supply for the entire line of the canal, including the cities of Panama and Colon. It would also provide a power plant for the generation of electric power sufficient to furnish ample power for the operation of the Panama Railroad and for the operation of any machinery that might be used in the construction of the canal.

It would require two years to build this dam, and, roughly estimated, its cost, including spillways, would be between $15,000,000 and $16,000,000, not including the power plant.

Cost, Under Each Plan.

Using as a basis the estimate of the former commission that a 90-ft. level canal would cost 200 millions, Mr. Wallace estimates that a 60-ft. level canal would cost 225 millions and could be completed and open for traffic in 12 years; a 30-ft.-level would cost 250 millions, to be open for traffic in 12 years, and fully completed in 15, while a sea-level canal would cost 300 millions, and could be open for traffic in 15 years and completed in 20 years. Mr. Wallace believes that the cost and the time required to complete the canal will depend on the economical and efficient handling of the material from the Culebra cut, and that every other question and problem connected with the entire work is subordinate to this. The control of the Chagres, the construction of the dams and harbor improvements and all other works are relatively less important. He points out that a sea level canal would be less expensive to maintain, less expensive to operate, save time in passage through it, and could be widened and deepened, when required, without interfering with traffic.

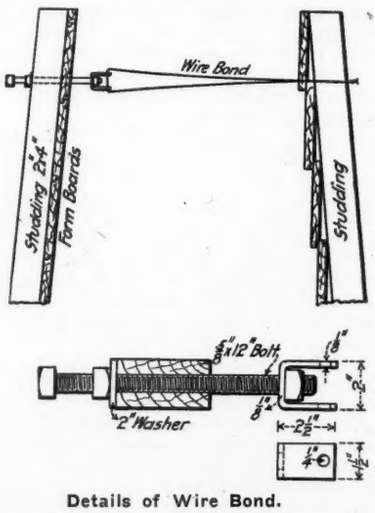


Concrete Form for Bridge Pier with Wire Bonds.

Tie for Concrete Forms.

BY M. H. M'GEE.*

The accompanying illustrations show the details and application of a simple form of tie for concrete forms for bridge piers and abutments which has been successfully used on the Ulster & Delaware for some time. It can be used at any point on the form regardless of the thickness of the concrete, is cheap, easily applied and removed. It consists of a ⅝-in. x 12-in. bolt, threaded for its entire length, a small wrought iron U-shaped stirrup, two nuts and some strong wire. The bolt is passed through a hole bored in the studding to which the form boards are nailed after a nut and washer have been run up under the head. The U-shaped stirrup is slipped over the end of the bolt projecting on the inside of the form, and the other nut is run up to hold the stirrup on. The wire bond is run through holes in the ends of the stirrup and carried across the form, through the boards, and is twisted around the studding on the other side. After the wire is fastened the nut on the outside of the studding is turned up and the bond drawn taut. When the work is completed and the forms removed the bolt itself is turned out of the nut holding on the stirrup and is pulled out of the concrete. The stir-



Details of Wire Bond.

*Assistant Engineer, Ulster & Delaware.

rup, nut and wire bond remain in the concrete, but the removal of the bolt leaves only a small hole in the surface ⅝ in. in diameter which can be neatly plugged up with cement mortar. It has been found preferable in practice to pass the bolt through a trimmer on the outside of the studding rather than through the studding itself because when holes are bored in the studs it weakens them. When the holes are put through the trimmers all of the parts of the form can be used over and over again. As far as the writer is aware this tie is original and has not been used on any other railroad or structural work. It is not patented.

Rock Island Motive Power Committee Report.

The committee appointed some time ago by the Rock Island to report on motive power matters has recently completed its work. The committee consisted of F. J. Cole, C. A. Seley and Robert Rennie. Through the courtesy of Mr. Robert Mather, President of the Rock Island Company, to whom the report was addressed, we are enabled to give a rather liberal extract from the recommendations and suggestions of the committee.

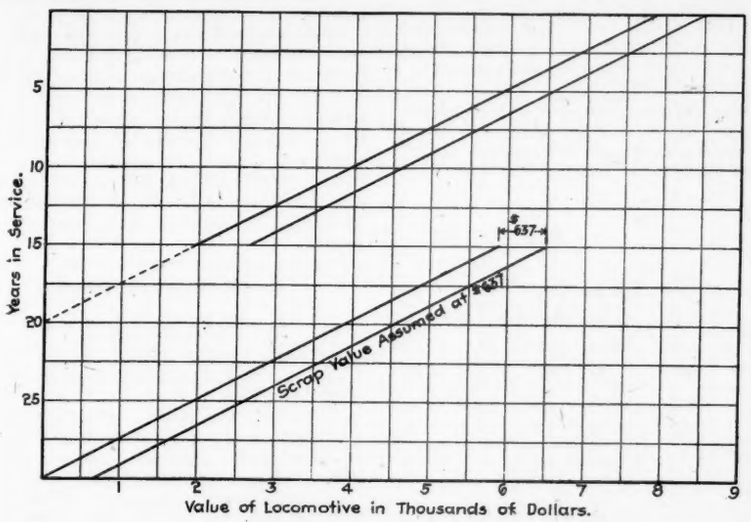
The report is divided into seven sections. The first section deals chiefly with the question of depreciation of motive power. It has been assumed that the average life of a locomotive is about 20 years. In general, it is not economical to continue to repair and keep in service old, light engines after their natural life. It is possible, however, that there may be a demand for light power, and on the Rock Island such a demand is likely to continue for several years. It thus becomes necessary to retain some of the light engines in service so as not to have a serious shortage of power. It is not desirable, however, to buy any more light engines, it being better to shift light engines from other parts of the road. Every expedient should be resorted to rather than buy new light engines. Only heavy engines should be purchased and added to the present power.

When the machinery, cylinders, frames, wheels, etc., of a locomotive are in good condition, it will be economical in some cases to renew the boilers and fire-boxes of light engines, provided the expenditure is based on some predetermined percentage of the original cost. This practice can be carried too far, however; as, for example, some roads spend 50 to 60 per cent. of the original cost of a locomotive for repairs. Furthermore, boilers having greater heating surfaces and higher steam pressures are often applied to engines having light machinery, etc., thus overstraining the bearings and other parts and ultimately causing failure in service. While such practice may temporarily improve the efficiency of a locomotive, the cost of repairs per running mile is much increased. In scrapping small switch engines careful consideration should be given to the fact that the mileage is low and hence the demands on the boiler are small. Table 1 gives the cost of repairs which should be allowed on certain light locomotives when both 20 and 25 years old and over.

Table 1.

Class.	Repairs when over— 20 years.	25 years.	Average cost of class.	Repairs allowed, 20 yrs.old.	25 yrs. old.
8-wheel:					
15-in.		5%	$7,000	....	$350
16-in.		5%	8,000	....	400
17-in.	10%	5%	9,000	$900	450
10-wheel:					
16-in.		5%	8,500	....	425
17-in.		10%	9,200	....	920
18-in.		10%	10,000	....	1,000
4-whl. switcher:					
15-in.	10%	5%	6,000	600	300
16-in.	10%	5%	6,500	650	325
6-whl. switcher:					
15-in.		5%	6,500	....	325
16-in.		5%	7,000	....	350
17-in.		10%	7,500	....	750
18-in.		10%	8,000	....	800
Mogul:					
17-in.	10%	5%	8,000	800	400
18-in.	10%	5%	9,000	900	450

In Table 1 the amount allowed for repairs and the extension of the age limit are due to the demand for light power which still exists on the road.



Depreciation of a Locomotive.
First Cost Assumed at $8,500.

The accompanying diagram shows the assumed depreciation of a locomotive from 1 to 30 years old, the original value being taken at $8,500 and the scrap value at $637. The effect of renewing the boiler after the engine is 15 years old is shown graphically, the effect being to prolong the natural life of the locomotive from 20 years to 30 years.

The second section of the report deals with the question of distribution of power to secure the segregation of engines of similar character in order to reduce the number of parts which must be carried in stock and to reduce the cost of repairs. The committee is of the opinion that the motive power officers can bring together some classes of engines which are now scattered. Attention is also called to the economies to be effected by the standardization of repair parts.

The next section of the report deals with changes in design of locomotives in order to increase their capacity and usefulness or prolong their life. The committee finds that the engines now in use are being worked close to their capacity, tonnage rating being largely responsible for this. Particular attention is called to benefits to be derived by purifying water in special plants for softening and settling. The removal of a large percentage of the solid matter in the water before it is delivered to the locomotive tenders is one of the most efficient means of increasing the usefulness of the power. A large portion of boiler repairs could be thus diminished. The efficiency of locomotives could also be increased, due to the absence of scale on the heating surfaces.

The fourth section of the report gives proposed standard types of locomotives which should be used in the future. This portion of the report goes considerably into detail, but for the purposes of this article only the general dimensions of the several types will be given, as follows:

Heavy Consolidation Locomotive.

Cylinders, in.	22x30
Drivers, in.	57
Weight on drivers, lbs.	180,000
Total weight, lbs.	200,000
Steam pressure, lbs. per sq. in.	185
Tractive force, lbs.	40,000

Medium-Weight Consolidation Locomotive.

Cylinders, in.	22x30
Drivers, in.	63
Weight on drivers, lbs.	160,000
Total weight, lbs.	182,000
Steam pressure, lbs. per sq. in.	185
Tractive effort, lbs.	36,200

Heavy 10-Wheel Passenger Locomotive.

Cylinders, in.	22x30
Drivers, in.	69
Weight on drivers, lbs.	134,000
Total weight, lbs.	176,000
Steam pressure, lbs. per sq. in.	185
Tractive effort, lbs.	28,680
Width of fire-box, in.	68

Atlantic Type Locomotive for Fast Passenger Service.

Cylinders, in.	21x26
Drivers, in.	73
Weight on drivers, lbs.	102,000
Total weight, lbs.	182,000
Steam pressure, lbs. per sq. in.	185
Tractive effort, lbs.	24,700

Six-Wheel Switcher.

Cylinders, in.	20x26
Drivers, in.	51
Weight on drivers, lbs.	138,500
Steam pressure, lbs. per sq. in.	185
Tractive effort, lbs.	31,200

Pacific Type Locomotive for Heavy Passenger Service.

Cylinders, in.	22x26
Weight on drivers, lbs.	136,000
Total weight, lbs.	203,000
Tractive effort, lbs.	31,000
Width of fire-box, in.	68

The trailing trucks of these Pacific type engines are to have outside bearings instead of the inside bearings now in use.

The fifth section of the report deals with the question of superheated steam. The committee believes that some difficulties will be experienced in American practice with the use of the Pielock superheater on account of the difficulty of removing and expanding the flues. A complete description of the several types of superheaters now in use is given. Attention is called to the fact that the use of superheated steam in earlier days was handicapped by the use of vegetable and animal oils for lubricating the valves and cylinders. With mineral oils of high fire test and seamless drawn tubes the problem is now easy. Tests in Germany and on the Canadian Pacific show that valves and cylinders can be properly lubricated and that superheater pipes and flues made of seamless drawn tubes do not corrode and wear out with undue rapidity. A life of several years can be obtained from the seamless tubes. The reports of the Canadian Pacific show that in three years' service the superheated steam compounds saved 10 to 15 per cent. in coal over compounds without superheaters.

Apart from the saving in fuel which results from the use of superheaters, one of the greatest advantages is that dry steam is always furnished the cylinders. It is practically impossible to carry over water into the cylinders, thus eliminating the danger

of "water hammers." Where foaming water is used superheaters will prevent trouble in the cylinders.

In concluding the discussion on superheated steam the committee says that there is no improvement in sight at the present time which affords so many advantages and so much economy both in saving of fuel and lessening of repairs as the use of superheated steam. The additional complication of the boiler is small, and superheaters of good design are not liable to expensive repairs, nor has it been shown that failures in service are frequent. In June, 1904, an Atlantic type engine, out of a lot of 20 for the New York Central, was equipped with a Schenectady superheater. The engine went directly into passenger service and has been running satisfactorily ever since. No trouble was experienced with the superheater, the only difficulty being due to the lubricating device which was of foreign make. The oil used was also of low fire test. Orders for 26 of this type have now been received.

The next section of the report discusses at length the question of composite motor cars. In many places it does not pay to run a regular passenger train as the wages of the engineer, fireman, etc., are out of all proportion to the receipts. Better service can also be given by one car running frequently than by a train making one or two trips a day. The usual construction of motor cars has been a passenger car body with seats for about 50, having one end partitioned off for the boiler. The development of these cars has been slow and not very successful, owing to the opposition of unions to the use of but two men and to the low steaming capacity of the boiler. The heating surface in most of these designs is only about one-half of that of a modern locomotive. The fuel used has been both hard and soft coal.

The largest number of cars have been operated by steam, but at the present time the following types are used: (1) Steam; (2) gasoline or oil engines in connection with direct coupled electric generators and electric motors; (3), gasoline or oil engines with mechanical drive, operated by gearing and friction clutches.

While the use of gasoline engines provides some attractive features, being self-contained and not requiring any particular attention from the engineer except for lubrication, the construction of these engines requires running at substantially high speeds, with a variation of not more than 40 to 50 per cent. Thus, in order to control the power and connect it to the wheels so that starting can be effected with smoothness and rapidity it is necessary to expend a large sum for electrical or mechanical devices. If the car is controlled electrically it requires a generator, two motors on the wheels and the usual arrangement of wiring, switches, controllers, etc. It also involves the use of compressed air for starting the engine. It is extremely questionable if a gasoline-electric device of this kind would pay unless gasoline could be obtained at an extremely low price or coal could not be obtained except at a very high price. The same reasoning holds in the case of gasoline or oil engine cars having mechanical drive.

The committee believes that a steam driven composite car with a large properly constructed boiler (preferably horizontal) having sufficient steaming capacity and using coal or oil, is the best solution of the problem. If oil fuel is used the valves controlling the admission of oil and air can be placed close to the engineer so that it would take but a small part of his time to control and maintain the steam pressure.

A preliminary design for use on the Rock Island is shown in the report. The car has a seating capacity for 50 and also has a small baggage room. The steam connections between the engine and boiler are made with flexible ball joints. The principal dimensions of the proposed car are given in the following table:

Weight on drivers, lbs.	74,000
Weight on front truck, lbs.	15,000
Weight on back truck, lbs.	40,000
Total, weight, lbs.	129,000
Total wheel base, ft.	62
Cylinders, in.	12x16
Drivers, in.	42
Engine truck wheels, in.	28
Diameter of boiler, in.	60½
Steam pressure, lbs.	180
Fire-box, in.	48 3-16x48 3-16
Tubes, No.	297
Tubes, outside diameter, in.	1½
Tubes, length, in.	92
Heating surface, tubes, sq. ft.	875
Heating surface, return tubes, sq. ft.	350
Heating surface, fire-box, sq. ft.	75
Heating surface, total, sq. ft.	950
Grate area, sq. ft.	16.7
Tractive effort, lbs.	8,390
Factor of adhesion.	8.82

The driving truck of this car is of the 2-4-0 type; that is, it has a pair of leading wheels and two driving axles. The cylinders are horizontal. The boiler is horizontal with return tubes. There are two cylindrical tanks holding 1,400 gallons. The fuel capacity is one ton. Table 2 gives some comparative figures on the cost of fuel for operating different types of 300 h.p. motor cars.

Table 2.

Type of car.	Cost of fuel. Per gal. or ton.	Cost of fuel. Per pint or lb.	Lbs. or pints per h.p. hr.	Cost per h.p. hr.	H. p. hrs. per day.	Cost of fuel—Per day—While running.	Cost of fuel—Per day—Addtl for raising steam.	Per 1,000 h.p. hrs.
Gasolene	$0.12	*1.5	1	1.5 cts.	1,500	$22.50	$22.50	$15.00
Steam car with simple engines; oil fuel	.024	†.32	†2.8	.89	1,500	13.35	14.70 (10%)	9.80
Steam car, compound engines, superheated steam, oil fuel.	.024	†.32	†2.1	.67	1,500	10.05	11.00 (10%)	7.33
Steam car, simple engines, coal fuel	2.15	†.1075	†4	.043	1,500	6.45	8.06 (25%)	5.33
Steam car, compound engines, superheated steam, coal fuel	2.15	†.1075	†3	.032	1,500	4.83	6.04 (25%)	4.03

*Pints. †Pounds.. Running 100 miles a day. Average horse-power assumed to be 150. Weight of oil, 7½ lbs. = 1 gallon.

The report contains the following conclusions showing the saving which may be expected by the use of a motor car instead of a two-car train hauled by a locomotive.

Approximate Cost.

Passenger car	$5,000
Baggage, mail and express car	5,000
Engine and tender	7,000
Total	$17,000
Motor car	12,000
Difference	$5,000

Weight of Train.

Passenger car	35 tons.
Baggage car	30 "
Engine and tender	65 "
Total	130 tons.
Weight of motor car	65 tons.
Difference	65 tons.

Cost per Day for Wages.

	Train.	Motor car.
Engineer	$3.50	$3.50
Fireman	2.25	2.25
Conductor	3.50	3.50
Brakeman	2.00	....
Baggageman	2.50	....
Total	$13.75	$9.25
Add for roundhouse care	3.00	
Total	$16.75	
Add interest on $5,000	1.00	
Total	$17.75	
Motor car wages	9.25	
Saving in wages	$8.50	
Saving in fuel	5.00	
Total saving for motor car.	$13.50	

The last section of the report presents a discussion of the four-cylinder balanced compound locomotive. The following advantages of this type of engine are noted: (1), balancing of reciprocating parts by similar reciprocating parts; (2), increase of weight on drivers due to absence of "hammer blow." At 60 miles an hour with 78 in. drivers the ordinary engine at each revolution increases or decreases the static weights on the rail by about 23 per cent.; (3), increase of from 25 per cent. to 33 per cent. over ordinary engine in the sustained horse-power at moderate and high speeds without change of boiler; (4), economy in the use of fuel, water and steam; (5), light moving parts. As the four-cylinder balanced compound has four sets of cylinders, cross-heads, connecting rods, etc., in place of the two sets in the case of the ordinary engine, it follows that each cylinder and connected part transmit but half the power otherwise required to be transmitted by the ordinary two-cylinder engine. It is thus to be expected that the cost of repairs for the four-cylinder balanced compound will be less than for the ordinary two-cylinder engine.

The four-cylinder balanced compound principle can be applied to Atlantic type, Pacific type and 10-wheel designs without increasing the wheel base and without making serious changes in the detail parts of the locomotive.

In concluding the report the committee calls attention to the fact that the greatest economy and refinement within the limits of good practice, as far as can now be seen, can be obtained by the use of the four-cylinder balanced compound locomotive with a superheater. As the additional weight of the superheater is only about 2,000 lbs., there seems to be no practical difficulty in its application to four-cylinder balanced compounds.

Erie Employment Bureau.

The Erie Railroad Company has lately established an employment bureau, and Mr. W. C. Hayes, formerly Assistant Mechanical Superintendent of the road, is at its head. It is to keep the records of all applications for employment, throughout the company's lines, below the grade of superintendent, except unskilled laborers. This will be followed by a distinct change of method of employing men for the service. The list of classes in which the employment of new men must not be confirmed without the final approval of the Superintendent of the Employment Bureau, includes Master Mechanics, Road Foremen of Engines in the Mechanical Department, Trainmasters, Roadmasters, Master Carpenters in the Operating Department among the higher classes, and includes call boys, messengers, dining car employees, and all the numerous head and hand workers between these grades.

After an application is sent in from any division point, all papers concerning the movement of the employee are forwarded to the Superintendent of the Employment Bureau for file. All applications are investigated by the bureau, the replies and all information of value being kept by the bureau for reference. Out of service, transfer, promotion or re-employment notices must also be forwarded to the bureau for file.

In this way a complete record of every employee is kept showing all information of value. When an application is made for a position of any kind below the rank of superintendent, and above that of unskilled

laborer, the officer or head of department to whom it is made has the regular application blank filled out. Applicants this year are required to show where and how employed from Jan. 1, 1900, to date. The record must be continuous and chronological. For any periods that the applicant may have been idle or working for himself or relatives, he is required to furnish the names, titles and post office addresses of two responsible business men to verify his statement. A personal description of the applicant is then made by the employing officer. The place of occupation, date effective and in what capacity he is employed is filled in and the application is then forwarded to the employment bureau for investigation and file. The bureau is the only authorized medium for conducting investigations, answering all inquiries relative to the record of former employees, giving service letters, etc., thereby relieving the employing officers of this duty.

It makes no difference whether a man works on one or more divisions, all records are forwarded to the bureau and recorded under one cover. It is only necessary to refer to the file to get the complete record of any employee, the file showing his record from the day he entered the service to the date of its termination. Any employee leaving the service is entitled to a certificate showing his record. The certificate of service is of considerable value to the owner, and in order to protect the person receiving such certificate, his signature and personal description are entered thereon. This prevents it from being used by any one other than the right person.

The examination for visual defects is made with worsteds and lanterns according to the most approved plan.

The discharge of unskilled laborers, wipers, etc., must also be reported when the cause of dismissal is such as to make the person an undesirable employee. All records include a physical description, to insure satisfactory identification.

The application blank requires the applicant to give, besides the usual information, the names of relatives dependent upon him. He acknowledges the receipt of a copy of the book of rules, and agrees to keep advised of amendments which may be made; acknowledges that he has received notice of the danger of overhead bridges, etc., and that when he goes into the yards of other companies he must be particularly careful in looking out for obstructions; agrees to examine machinery, etc., before using, to see that it is safe, and to report in writing to "some person superior to myself" when defects are found. The employing officer fills in the name of the predecessor in the place for which an applicant is being engaged, and the disposition made of the predecessor; also the rate of pay.

Of the 15 blanks and other forms used by the bureau, the principal ones are the following:

2181. Inquiry to be sent to references who can verify statements made by applicants who have been out of work for some time.

2182. Certificate of examination of locomotive engineers and conductors by the division superintendent, when persons employed in these capacities have passed a satisfactory examination on train rules. In the mechanical examination of engine men then is also the mechanical examination and the certificate is signed by the Master Mechanic, when a satisfactory examination has been passed.

2183. Letter from the applicant authorizing former employers to furnish his record.

2184. Certificate of examination of eyes and ears.

2185. Letter from examiner to surgeon, requesting surgical examination.

2186. Certificate of service, to be issued only by the superintendent of the employment bureau, to be given to employees leaving the service. This certificate must have a physical description and must bear the signature of the employee.

2187. Application for employment (mentioned above). This must be attested to by a witness who has heard the whole document read over and must be sworn to by the applicant before a notary public. The record of previous service accompanying this application fills a large page and has 20 numbered lines, one line for each place or occupation. This is intended to go back five years, and if an applicant has been idle he must give the names of two responsible business men who will testify to the correctness of the record which he gives for such periods of idleness.

2196. Instructions for surgeons and other examiners. This is a circular of six pages, taken up mostly with the tests for color sense and acuteness of vision. For trainmen, etc., normal hearing, color sense and visual powers are required. For station agents, section foremen, etc., 20/40 visual power will be accepted in one eye if the other is normal; or 20/30 will be accepted in each eye. No applicant will be accepted who must wear glasses to meet the requirements. Firemen and brakemen already in the service may be promoted if they have 20/20 in one eye and 20/30 in the other, provided they have no other defects.

The list of physical disabilities which bar employment is quite long, extending from the loss of an eye, leg or arm to recurring appendicitis and marked scrofulous cachexia. The surgeon in his record must note not only physical defects which impair the usefulness of the applicant, but those which do not. All new men employed in the train, engine, and switching service must be between 21 and 45 years. Persons under 21 will be accepted only as messengers and as apprentices in shops.

2197. Record of the "practical" test of eyes and ears. This form is shown, reduced, in the accompanying cut.

2198. Surgeon's certificate of examination. The applicant must make oath, on the back of this sheet, to the truth of the answers which he has made to the surgeon's questions. The blank contains a diagram of the human body and also of the hand and of the foot, on which the surgeon is to indicate physical defects.

2199. Record of examination of eyes by Holmgren worsteds and Dr. Williams' testing lantern. If the applicant fails to pass this examination he may then take the "practical" test with the different colored flags and lamps as per Form 2197, to convince him of the fairness of the first test.

2200. Inquiry to be sent to former employers.

2202. Instructions for making up applications.

3003. Recommendations for promotion, transfer or re-employment. This is to be signed by the head of division or department and must give the record of the employee. If a person recommended for promotion is not next in line, the certificate must explain why an exception is made. Among the questions

ERIE RAILROAD COMPANY.

CHICAGO & ERIE R. R. NEW JERSEY & NEW YORK R. R.
NEW YORK, SUSQUEHANNA & WESTERN R. R.

RECORD OF EXAMINATION OF SIGHT, COLOR SENSE AND HEARING.

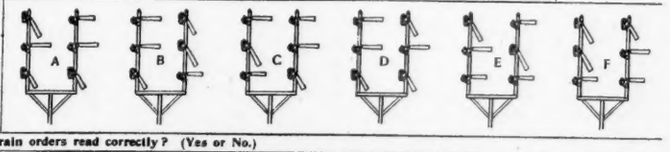
NAME _____ OCCUPATION _____ DATE _____

PLACE _____ TIME _____ WEATHER _____

SIGHT.

Order Shown

Combinations of Signals Shown. X indicates called Reverse Position.



Written train orders read correctly? (Yes or No.)

COLOR SENSE.—Standard Flags, Shown Two at a Time

Order Shown																					
Color Shown	New Green	Soiled Yellow	Soiled Red	New Green	New Red	Soiled Red	New Green	Soiled Green	New Blue	Soiled Red	Soiled White	Soiled Green	Soiled Red	New Red	New Yellow	New Red	Soiled Green	New Green	New Green	Soiled Red
	1	20	13	1	11	19	1	2	31	12	40	2	13	11	21	11	2	1	1	12
Name Given																				

Standard Flags, Shown One at a Time.

Order Shown										
Color Shown	Soiled Green	New Red	Soiled Red	New Yellow	New Green	Soiled White	New Blue	Soiled Yellow	Soiled Green	Soiled Red
	2	11	12	21	1	40	31	23	2	13
Name Given										

Standard Lanterns, Shown Two at a Time.

Order Shown																				
Color Shown	Light Green	Dark Green	Dark Red	Light Green	Light Red	Dark Red	Dark Green	Light Green	Yellow	Dark Green	Light Red	White	Dark Red	Light Red	Blue	Yellow	Light Green	Dark Red	Yellow	White
	1	2	12	1	11	12	2	1	21	2	11	41	12	11	31	21	1	13	21	41
Name Given																				

Standard Lanterns, Shown One at a Time.

Order Shown									
Color Shown	Dark Red	Light Green	Blue	White	Dark Green	Yellow	Dark Red	Light Red	Yellow	Dark Green
	13	1	31	41	2	21	12	11	21	2
Name Given										

Hearing: Ordinary conversation heard correctly? (Yes or No.)

REMARKS.—I hereby certify that I have personally examined _____ and find that his acuteness of vision, color perception and hearing _____ conform to the standard required for _____

Date, _____ (Signed) _____ Examiner.

Form for Recording Test of Vision of Employees of Erie Railroad.

Reduced about one-half.

to be answered in filling out this blank is, "Does the subject of this report display industry and zeal?"

3004. Notice to be sent by the head of the division or department to the employment bureau, of cases where discipline has been ordered (to be recorded), and of dismissals or resignations. In case of violation of rules the number of the rule must be stated, and if discipline is administered in connection with an accident, the names and titles of other employees disciplined for the same cause must be given. The office of the superintendent of the employment bureau is at Jersey City, and that will be the headquarters of the department; but he will have assistants at division terminals and wherever necessary so as to provide for the transaction of business with the necessary promptness.

American and British Railroad Accident Reports.*

British statistics of railroad accidents are collected and used not to horrify humanity, but to locate the causes and responsibility, and, where possible, to prescribe and enforce the remedy. American statistics of railroad accidents are collected, tabulated and published to establish a preconceived theory; to shift the responsibility from the human equation to the absence of some safety device; to convict our railroad management of a niggardly disregard of human life. In England the statistics are only published for the purpose of reassuring the public. In America they are given out by the Interstate Commerce Commission no less than seven times a year, with "ghoulish glee," to fill the public mind with horror over the harrowing totals of every description of frightful or trivial railroad accident.

In England in 1901 the report of the British Board of Trade very justly made much of the gratifying fact that for the first time on record not a single passenger had been killed in a train accident. This noteworthy event, which has been rolled as a sweet morsel through the disingenuous reports of the Interstate Commerce Commission, served to divert attention from the co-incident fact that the total number of personal accidents was 1,277 persons killed and 18,735 injured. If you multiply these figures by ten, which represents the difference in risk by reason of the greater mileage, tonnage and number of employees in America, you have 12,770 killed and 183,750 injured as the gross totals, which should be compared with the totals so assiduously paraded in the government reports to induce Congress to give the Interstate Commerce Commission authority to prescribe costly safety devices for the problematical protection of the people. . . . The English reports put in a separate class those accidents not caused by the movement of cars or engines; Mr. Thompson says that the inclusion of these accidents in the United States reports [They are separated here, the same as in England] can be due only to "a deliberate policy to inflame public opinion against the railroads by the inclusion of these irrelevant statistics."

The paper then goes on to quote from accident investigations made by Colonel Yorke; this to show his judicial tone. The principal extract is from the report on the accident at Glasgow, July 27, 1903, killing 16 passengers, in which Colonel Yorke recommended the English roads to follow the example of other countries in having more efficient power brakes. Discussing the totals of English records, Mr. Thompson says:

*Abstract of a paper by Slason Thompson, read before the Western Railway Club, at Chicago, Dec. 20.

Even during the year 1901, memorable for its immunity from fatalities to passengers in accidents to trains, there were in the United Kingdom 51 collisions between passenger trains or parts of passenger trains; 55 collisions between passenger trains and freight trains; 29 collisions with buffer-stops and 65 cases of passenger trains or parts of passenger trains leaving the tracks, and there were 476 passengers injured in train accidents, the majority of whom owe gratitude to their lucky stars and not to any block signal, that the death which came so near passed them by.

Coming now to American records Mr. Thompson presents the following figures:

Killed in Railroad Accidents.

	1888.	1904.
Passengers	315	426
Employees	2,070	3,367
Other persons	2,897	5,879*
Total	5,282	9,666

*Figures on "other persons" are for 1903, as figures are not yet out for 1904.

Against these figures any one wishing to deal honestly and fairly with the subject should set the following, taken from the earliest and latest available reports of the Interstate Commerce Commission:

	1889	1903.
Passengers* (millions)	11,553	20,915
Tons* (millions)	68,727	173,221
Employees	704,743	1,312,537

*Carried 1 mile.

Here we see the following percentages of the relative increase in the totals of fatalities and factors in the hazard of railroad operation:

	P. c. of inc. 16 yrs.
Fatalities to passengers	32.4
Fatalities of employees	62.6
	15 yrs.
Passengers carried 1 mile	93.7
	14 yrs.
Tons carried 1 mile	152.0
No. of employees	86.2

Fatalities due to train movement were as follows:

Killed in Train Accidents.

	1889.	1904.	Per ct. inc., 15 yrs.
Passengers	161	270	67.7
Employees	481	844	75.4

These figures demonstrate that the fatalities from train accidents have not increased relatively to the number of passengers carried one mile or to the number of employees, omitting all consideration of the overshadowing increase in the ton mileage.

During the last five years from 1900 to 1904, inclusive, there were 795 passengers killed in train accidents, or an average of 159 each year. During the first five years of the Commission's statistics from 1889 to 1893, inclusive, there were 679 passengers killed in the similar class of accidents, or 135 each year: making an increase of only 17 per cent. during a period when the average passenger mileage for the five years in question increased 52 per cent. But these comparative figures are only profitable as a refutation of the popular impression that the railroads of the United States are managed with an increasing disregard to the safety of passengers and employees. The opposite is the truth.

The indictment I bring against the accident statistics of the Interstate Commerce Commission is that they not only fail to reflect the true conditions, but that they are deliberately perverted to further a preconceived and fallacious theory as to the best means to prevent railroad accidents. As I have already more than intimated, the gross totals have been paraded before the popular imagination as the frightful mortality to be reduced by block signals. With the introduction of block signals wherever practicable and where they will insure public safety without overburdening public traffic, I am in hearty sympathy.

But the accident reports of the Interstate Commerce Commission, prejudiced as they are in favor of the block signal system as the panacea for railroad accidents, cannot wholly conceal the fact that recklessness, negligence and disobedience in the human equation is mainly to blame for railroad accidents. In three cases out of four where the block system is installed the failure of the human equation to keep it in order or to observe or obey its warnings neutralizes its efficiency. The inevitable tendency of the block signal system is to beget carelessness in the train crews, as it shifts responsibility to the signal system operators or to the signal itself.

The rest of the paper is a violent attack on Secretary Moseley, of the Interstate Commerce Commission, based on statements made by Mr. Moseley in an article in the *American Monthly Review of Reviews*, for November. The author disputes Mr. Moseley's classification, in which he separates collisions caused by the block system from those occurring on the roads where it is not in use, and declares that Mr. Moseley's allegations concerning trainmen sleeping on duty and collisions caused thereby are not proved.

For the real causes of any increase which there may be in railroad accidents in this country Mr. Thompson refers to the *Locomotive Firemen's Magazine*. From an article in that magazine he quotes the opinion that greater exactions in train work, the running of locomotives three times as large as formerly, and of 50-ton cars; requiring men to run 150 to 200 miles in the same time that they formerly took for 100 miles, and, in general, the making of duties extremely complex, constitute the true explanation. The men are now sober and more closely attentive to duty than formerly, and do not loaf in saloons but spend their leisure time at home or in study of their intricate and exacting duties.

Mr. Thompson says that on 35 roads operating over 31,000 miles in 30 American states and three territories, which carried 4,886,641,267 passengers one mile, not a single passenger was killed in a train accident in the calamitous year of 1904 (year ending June 30.) Nine other roads, operating 21,655 miles in 31 states, carried 2,626,197,777 passengers one mile with a fatality of only one passenger to each road during the same year. Together these reports show that 44 American roads operating in 38 states and three territories 52,685 miles, or more than 2¼ times as much as the total mileage of British roads, carried over 7½ billion passengers one mile, last year with only nine fatilities to passengers in train accidents. . . .

The remedy for our accidents lies along the suggestion made in the President's message and following the English practice, viz.: "personal investigation through proper officers of all accidents involving loss of life which seem to require investigation, with a requirement that the results of such investigation be made public." The officers should be chosen from the engineering service of the regular army, and should be paid as well as their English compeers. The present farcical system of inspection of tens of thousands of locomotives and nearly two million cars should be abolished, and the railroads should be held to double damages where the government officials find that the fatal disaster was due to defective equipment or permanent way. But this reform should begin by removing the whole subject of railroad accidents from the hands of the Interstate Commerce Commission and placing it with the Bureau of Commerce and Labor, where it belongs. At present the subject cannot receive honest and intelligent public consideration for the stream of statistics relating to it is poisoned at its fountain head.

Railroad Shop Tools.

(*Continued.*)

SHAPING MACHINES.

The 15-in. Universal shaping machine, Fig. 1, is made by the Potter & Johnston Machine Company, Pawtucket, R. I. This type of machine bears somewhat the same relation to the plain shaper that the universal milling machine bears to the plain milling machine.

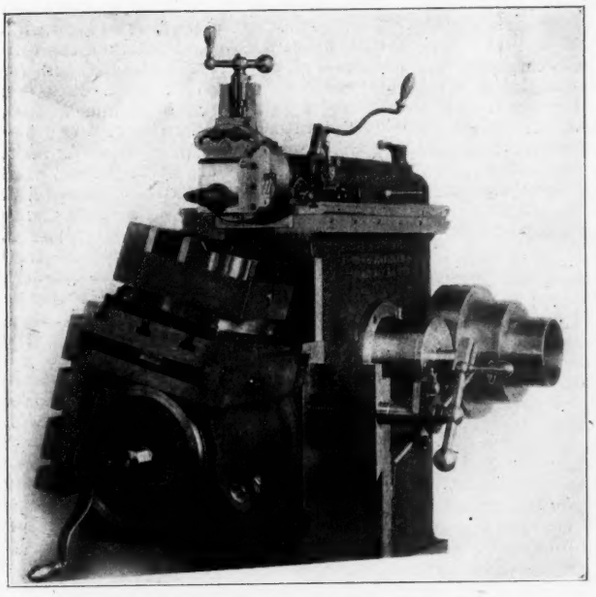


Fig. 1—The Potter & Johnston Shaper.

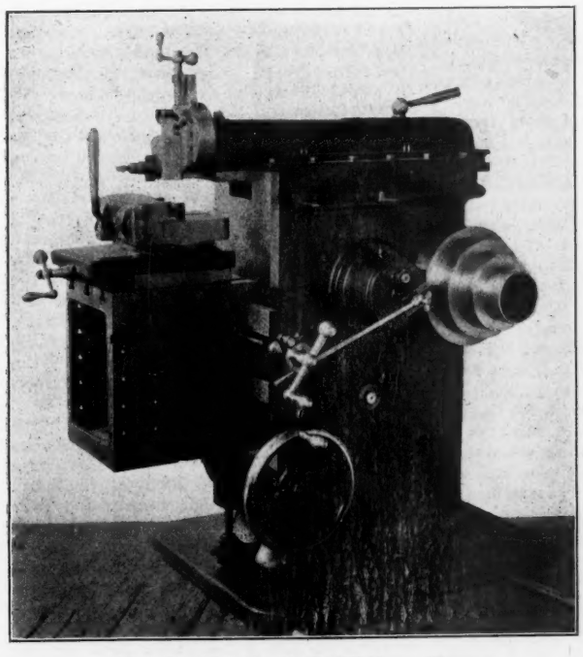


Fig. 2—The Pratt & Whitney Shaper.

The ram has quick return and a graduated dial enables it to be set quickly to any length of stroke while the machine is in motion.

The cross slide is mounted on ball bearings and the cross slide feed screw has a graduated collar for adjustments, as has also the tool head feed screw. The tool slide has 10 changes of down feed and an automatic stop for duplicate work. The down feeds and automatic stops can be used while the head is in any angle from 0 to 90 deg., and feed changes can be made while the machine is in motion. The change of feed is made by throwing an index finger to the left or to the right and allowing the spring finger to engage in the desired hole in the face of the disk upon which the index finger rotates. When the pin is in the lower left-hand hole the feed is zero. The down feed is controlled by a knurled screw, which is set in a radial slot in the side of the ram and engages the stop finger.

The table or knee is graduated and swings in either direction through an arc of 90 deg. It is also fitted with an auxiliary tilting slide for compound angles, thus making it possible to plane work to any angle with the power cross feed. Rotary motion is imparted to the table by means of worm gearing. This type of machine is also made in the 24-in. size; in this size the table is raised and lowered by power. The following table gives the dimensions and weights of both the 15-in. and 24-in. machines:

	Machine	
	15-in.	24-in.
Length of stroke	15 in.	24 in.
Auto. cross traverse	20 in.	23 in.
Vert. adjustment table	12 in.	16½ in.
Top of table	14x12 in. (plain) (swivel)	21x15 in. 17½x15 in.
Side of table	14x12 in.	18¼x17¾ in.
No. grades of cone	4	3
Swivel vise opens	4½ in.	6 in.
Length of jaws	10 in.	12 in.
Tight and loose pulleys on counter	(2) 12x3 in.	2 pr., 10 & 14 in. for 4-in. belts.
Revs. per min.	150	170
Net weight of machine with countershaft	2,300 lbs.	4,000 lbs.

The accompanying illustration, Fig. 2, shows a 14-in. Pratt & Whitney precision shaper, made by the Niles-Bement-Pond Company, New York. This machine has ample power and rigidity for ordinary shop use, but is particularly designed for tool-room and die work. All adjustments are quickly made from one side of the machine and the screw which elevates the knee is provided with ball thrust collars, making it easy to adjust. The table has variable power feeds in both directions and is fitted with a swivel vise having a solid base. The vise turns on a graduated circle so that work may be adjusted to any horizontal angle. One of the jaws is V-shaped, for holding circular pieces and swivels so that either the V-shaped face or the straight face may be used. The maximum stroke of this machine is 15 in. and the table, which is 15 in. x 12 in., has a vertical adjustment of 11 in. and a horizontal traverse of 16 in.

Fig. 3 shows a 20-in. single-geared crank shaper made by the R. A. Kelly Company, Xenia, Ohio. The ram of this machine is semi-circular in section and is ribbed internally to resist all undue strains. It has a bearing of 30 in. in the top of the column. The length of the stroke of the ram is changed by means of a short lever. Graduations are produced for the head which can be swiveled to any angle and locked in position by a simple locking device. The top of the table is 12 in. x 15½ in. It is of box form with extension front and is provided with T slots on both the top and sides; it also has a V slot cut in its side for holding round stock in a upright position. The table can be easily removed to allow of work being strapped directly to the apron, which has an automatic cross feed of 22 in. and a vertical adjustment of 14½ in. The vise has steeled-faced jaws 12 in. x 2 in. and has a maximum opening of 8 in. It is also provided with hardened steel centers and a graduated swivel base. The cone pulley has four steps for a 3 in. belt. The tight and loose pulleys are 12 in. in diameter by 4 in. face and should run at 175 r.p.m. The net weight of the machine, including the countershaft, is about 2,400 lbs. This machine

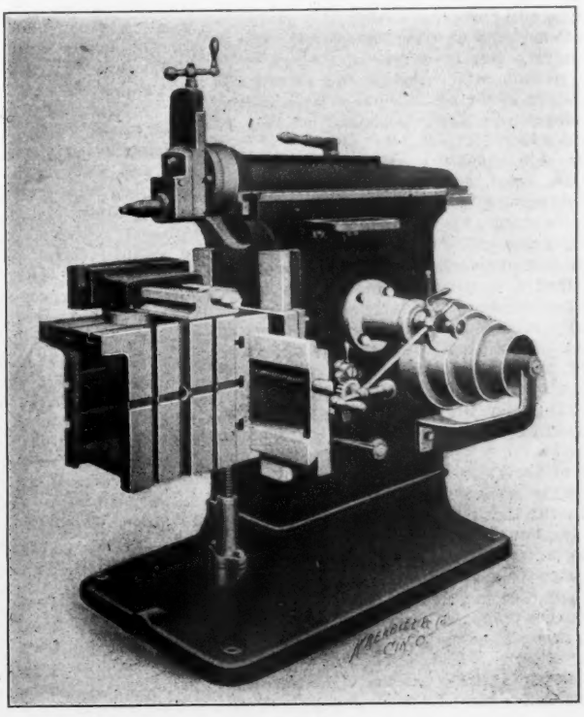


Fig. 3—The R. A. Kelly Shaper.

is also furnished with back gears and motor drive when desired.

(To be continued.)

Water Famine on the Pennsylvania.

At last accounts there had been no relief from the severe drought in central and western Pennsylvania. The Pennsylvania Railroad has kept 180 tank cars fully occupied night and day in transporting water to points where it was needed by the locomotives. Much water has had to be supplied to the shops in Altoona, and in spite of the best efforts some departments of the shops have had to stop work at times. The company is hurrying the work on a pipe line six miles long which is designed to afford a new supply of water at Altoona. On Sunday, December 18, the freight movement between Pittsburg and Harrisburg was one of the heaviest on record, every available engine being put in service to clear up blockades which existed at a number of points, and the water-train service was taxed to its limit. An officer of the road is quoted in the *Altoona Mirror* as follows:

"This water famine has been tightening its grip upon the Pennsylvania Railroad and its branches west of Harrisburg since the middle of August. The trouble extends to a considerable distance west of Pittsburg. By the employment of all manner of expedients and at the expenditure of immense sums of money we have kept our passenger movements intact and recently have forced freight movements up to the point where we are only about 24 hours behind. Here in Altoona our three big reservoirs, having a storage capacity of about 300,000,000 gallons, are all dry and have been for weeks. We have put on water trains and established temporary pumping stations. Our present consumption of water is about 3,000,000 gallons daily.

"Of this 1,000,000 gallons are supplied by the streams that formerly filled our reservoirs, the water now flowing directly into the pipes. By means of tank trains we supply daily about 600,000 gallons, and the remainder, amounting to 1,500,000 gallons, is furnished by pumps. This supply is uncertain and, coming from various sources, occasionally results in conflicting pressure and breaks in the pipes. Then the perplexities of the situation multiply. Yesterday afternoon we had six big trains waiting to start westward over the mountains. Each train required three locomotives, but there was a break in the water system somewhere and none of the locomotives could be got ready without serious delay. One night the boilers in the lighting plants ran out of water and for hours the yards were in darkness. A day or two ago the air operating all the yard signals was stopped for a similar cause. Two minutes are usually required to fill a locomotive tender with water under ordinary conditions; 25 minutes were required yesterday.

"Another serious drawback is the effect of the bad water we are compelled to use. We pump mine drainage into our boilers. At the end of every trip, sometimes before the trip is completed, the locomotive has to be sent to the shops that its boiler flues may be caulked. The sulphur in the water oxidizes the iron and renders the boilers unfit for use until overhauled; but, it is mine drainage or nothing in many cases. Every water station between Altoona and Pittsburg, as well as on the branches, is dry, or supplied by pumpage. An expert tests the water at the pumping stations, and decides the amount of soda ash to mix with the sulphur-laden water put into the tenders, but even at that the locomotive is good for only one trip without overhauling.

"We have 1,000 men working day and night constructing a six-mile line of pipes from Tipton Run. We expect to bring 1,500,000 gallons of water from that source by January 1. We will divide that with the city, which is in very bad shape for water. To-day the shops are working practically with water hauled in trains from Sunbrook. There is absolutely no pressure on the water in the company's mains, the streams are so low. It has been ascertained that muskrats have bored holes in the company's reservoir at Pinecroft, permitting what little water there was in it to run away. Fifty fire extinguishers have been distributed in the shops for protection against fire, and three reels of hose, containing 100 ft., have also been added to the shop fire equipment."

The Railroads of Natal.*

Unlike most of the other South African colonies, Natal does not depend to any extent upon gold and diamond mining, the only benefits it receives from these sources being due to the transportation of men and minerals between the mining centers of neighboring colonies and the port of Durban. It owes its importance rather to the development of agriculture, and, in a lesser degree, to manufacturing industries and coal mining. At the present time there are 762 miles of railroad in operation. Numerous surveys for new lines have been made and several of these will probably be built before many years have passed. The natural difficulties of building railroads in Natal, however, are extremely severe, involving heavy grades and sharp curves. There are very few miles of really level line, and most of this is on branches where the loads are light and gradients are not of much consequence. As an example; the ruling gradient on the main line between Durban and Ladysmith, 190 miles, is over 3 per cent. The train running from Durban to Charlestown, on the Transvaal border, has to ascend an equivalent of nearly 2½ miles of vertical elevation, crossing altitudes of from 2,000 to 5,000 ft. above sea level, which, when once reached, are often lost again and have to be recovered. Owing to these severe grades, the engine loads have to be reduced and readjusted at intervals, involving a loss of time and compelling even the most powerful of locomotives to be restricted to trains weighing 200 tons or less, whereas the same engines if working under British conditions, for example, would be able to pull an 800-ton train at full speed. With these facts in mind, such allowances as 229 minutes for 70 miles, which is the running schedule of the express train between Durban and Pietermaritzburg without any intermediate stops, appears quite reasonable.

The lines are of 3 ft. 6 in. gage. There is no second track except for about six miles in the neighborhood of Durban, where there are several long sidings to enable trains to pass one another. The main line of the Natal railroads extends from Natal to Pietermaritzburg, 70 miles, and thence to Charlestown, 306 miles, where it connects with the Central South African Railroads. From Ladysmith there is a branch to Harrismith, 59 miles. Other branches are: Greytown to Pietermaritzburg, 64 miles; Glencoe Junction to Dundee, 59 miles, and the Richmond branch, 17 miles. From Durban, there are three branches: one in a northerly direction to Sonkele, 169 miles; another south to North Shepstone, 72 miles, and the third to Unzinto. There is also a line two miles long connecting Durban with the docks. This was the first railroad built on the African continent (in 1860), and it is on record that when, as frequently happened, both of the two small locomotives of the line were out of commission, the trains had to be pushed along by natives. At Durban are situated complete and extensive docks fitted with up-to-date appliances. It is here that connection with all parts of the world is effected.

The rolling stock employed on the Natal railroads is exceptionally good and, notwithstanding that the gage is less than the British standard, the carrying capacity, both for passengers and for freight cars, is little less than would be the case in equipment used on standard-gage lines. The first and second class carriages used on these railroads are as good as is any in Great Britain. The vacuum brake is universally employed and most of the passenger coaches have clerestory roofs with windows made to open as well as door windows, a boon for the traveler during the hot weather. The standard locomotives used at present are heavy 10-couple tank engines designed by C. W. Reid, the late Locomotive Superintendent. The first and fifth pairs of couple wheels are not provided with flanges and the engines are consequently well adapted for rounding the sharp and frequent curves. About 100 of these locomotives are now in use in Natal, and the bulk of the traffic is done by them. The engines, as a rule, weigh a trifle over 100 tons with tender.

*From a paper in the December *Cassier's*.

Proposed Union Station for Buffalo.

The railroad terminal situation at Buffalo is exceedingly complex, not only on account of complications arising from the physical relation of the tracks of the thirteen railroad companies now entering the city, but also because of the many movements that are required in breaking up and making trains from the east destined over different routes for the west, and *vice versa*. Within the past 20 years the city of Buffalo has appointed a number of committees to confer with the different railroads with the end of securing a union station, but none of these committees was able to arrive at any definite results. A committee composed of five citizens of Buffalo, C. W. Goodyear as chairman, was recently appointed by the Mayor, and has now submitted to the railroads five proposed sites for a union station. These sites were discussed at a conference held in New York, at which the following railroads were represented: Delaware, Lackawanna & Western, Lehigh Valley, Erie, Pennsylvania, Buffalo, Rochester & Pittsburg, Buffalo & Susquehanna, New York Central & Hudson River, New York, Chicago & St. Louis, Lake Shore & Michigan Southern, Michigan Central, Grand Trunk, and Pere Marquette. The Wabash was unable to have a representative at the conference, but expressed its willingness to co-operate with the other roads. At this meeting the suggested sites were carefully considered and it was agreed that the one on Genesee street known as the Cary site would be the ideal location for a union station. Accordingly, a committee appointed by the railroads was authorized to say that the roads would consider favorably the project for a union station on the Genesee street site, to be jointly built and worked, provided suitable arrangements could be made with the city.

The approximate cost of the proposed terminal will be about $15,000,000, of which $11,000,000 is to be spent by the railroads and about $4,000,000 by the city. The general plan and further details of the station will be given in the next issue of the *Railroad Gazette*.

GENERAL NEWS SECTION

THE SCRAP HEAP.

The Southern Pacific has prepared plans for a hospital car, and a number of such cars are to be built at the Sacramento shops.

The embargo on freight destined for points on the New York, New Haven & Hartford has been lifted, announcement to this effect having been made by the Pennsylvania Railroad last week.

A press despatch from St. Louis says that the National Good Roads Association has arranged with the Missouri, Kansas & Texas to run an educational good roads train over the M., K. & T. lines, starting January 9. The National Good Roads Convention has been called to meet at Jacksonville, Fla., January 20 and 21.

The Chicago & Eastern Illinois is now actively competing in Chicago for freight to St. Louis and other southern points, and the newspapers say that a rate of 18 cents has been made on packing house products to the Gulf of Mexico; it is also reported that similar low rates have been made on low grade commodities from St. Louis to New Orleans.

The Subway railroad in New York City is now carrying upwards of 300,000 passengers a day. For the first month of its operation (November) the average daily traffic was about two-thirds of this number and the increase is mainly due to the opening of the Lenox avenue branch north of Central Park. The prevalence of rain, snow and cold weather has, however, turned much traffic from the surface and elevated lines to the Subway on many days of the past month.

Mr. Jackson, the Industrial Commissioner of the Erie Railroad, has issued a list of the new factories established in the towns and cities on the Erie road during the fiscal year ending June 30 last. The list is a long one and includes a great variety of manufactures from asbestos pipe covering, automobiles and bleaching works, to terra cotta, veneer and wool batting. A large majority of the establishments shown have side tracks connecting directly with the Erie lines. Mr. Jackson has in his office full information concerning the resources of the towns on all parts of the Erie system, and the circular sets forth his facilities for aiding manufacturers seeking places to set up new industries.

Barge Canal Contracts 3 and 4.

On Dec. 23 the Superintendent of Public Works at Albany, N. Y., opened 11 bids for contract No. 3 of the 1,000 ton barge canal work, and four bids for contract No. 4. Contract No. 3 calls for the excavation of the Champlain Canal from below Fort Miller Lock, No. 60, to above the Guard Gate at Crocker's Reef, the construction of the Fort Miller lock and a bridge. Contract No. 4 calls for the construction of the Erie Canal from Lock 25 to deep water east end of Oneida Lake at Sylvan Beach, a distance of 4.83 miles. All the bids are said to be under the engineer's estimates, which were $874,000 for contract No. 3, and $934,000 for contract No. 4. It is semi-officially announced that the low bidders for contract No. 3 were Sunstrom & Stratton, general contractors, 143 Liberty street, New York City, whose bid on its face was $670,497, and for contract No. 4 L. W. Bates, civil engineer, 74 Broadway, New York City, whose bid totaled $726,815.

The Year's Traffic at Sault Ste. Marie.

Mr. Joseph Ripley, General Superintendent of the canals at Sault Ste. Marie, submits the following annual report of traffic through the canals for the season of 1904:

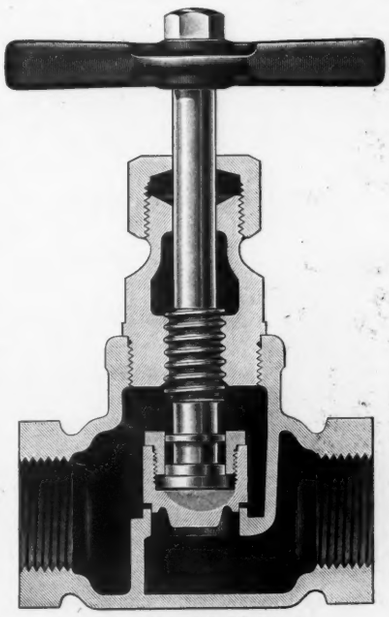
	Seasons		Dec.,
	1903.	1904.	per ct.
Vessels:			
Steamers, No.	14,027	12,188	13
Sailing, No.	3,569	2,994	16
Unregistered, No. ..	1,000	938	6
Total passages ...	18,596	16,120	13
Lockages, No.	11,642	10,315	11
Tonnage:			
Registered, net	27,736,444	24,364,138	12
Freight, net tons...	34,674,437	31,546,106	9
Passengers, No.	55,175	37,695	32
Coal: Hard, net tons..	1,149,005	991,228	14
Soft, net tons.....	5,788,628	5,463,641	6
Flour, bbls.	7,093,380	4,710,538	34
Wheat, bush.	61,384,552	49,928,869	19
Grain,* bush.	32,095,646	33,030,992	3†
Mfd. & pig iron, nt tns	193,267	229,985	19†
Salt, bbls.	454,882	365,459	20
Copper, net tons	112,877	109,605	3
Iron ore, net tons	21,654,898	19,635,797	9
Lumber, M. ft., B. M..	1,003,192	923,280	8
General mdse.,net tons	659,839	732,009	11†

*Other than wheat. †Increase.

The United States Canal was opened May 5 and closed Dec. 13, 1904; season, 223 days. The Canadian Canal was opened April 30 and closed Dec. 25, 1904; season, 240 days.

The Hancock Valves.

The Hancock globe, 60 degree angle and cross valves, are made in both the flanged and screw types up to the 3 in. size. These valves will stand a water pressure of 1,000



The Hancock Valve.

lbs. without leaking and are guaranteed to work under a steam pressure of 500 lbs. It is claimed that in an actual test the bodies of these valves withstood a pressure of 4,000 lbs. per sq. in. without breaking. The discs are of a special mixture which does not contain zinc and the spindles are Tobin bronze. The valve is guided on the stem by two collars which guide the disc nut, thereby compelling the disc to seat squarely. The valve seat is flat and the valve disc has a projection on it which acts as a guide when the seat is being ground. It is also claimed that when the valve is slightly raised from its seat, this projection allows the escaping steam to clean the seat of all dirt and foreign matter. These valves are made by the Hancock Inspirator Co., New York.

An English View.

From *The Engineer* (London).

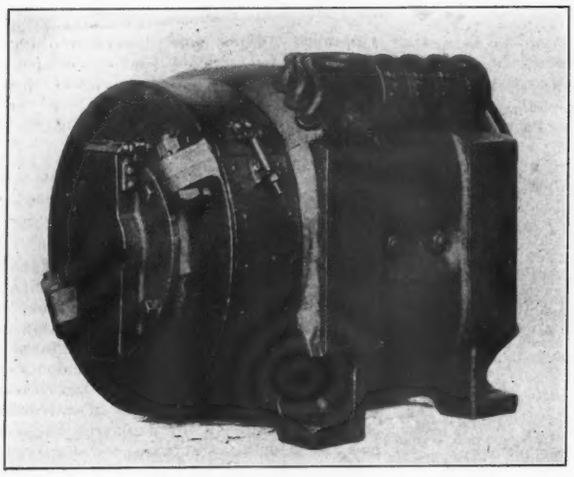
The worst accidents on British railways are derailments. We never hear of a train going through a bridge. Collisions are due to fogs, for the most part, and, secondly, to mistakes made by drivers or signalmen. Individuals are run over, and shunters are caught under trains or between buffers. In the United States the worst accidents are due to the failure of bridges or trestles, collisions, and the running over of individuals at level crossings. Simple derailments are not exceptionally numerous. We may say, therefore, that in the United States material plays a much larger part than it does in this country; and the disasters which are brought about by personal errors are largely the result of systems of working which are radically defective. Thus, in the United States there is an enormous single line mileage. Roads of this kind can only be worked safely by inflexibly observing the rule that there shall be only one train staff to each section, and that no train shall be permitted to run without this staff. . . . If the people of the United States were resolved that railroad traveling should be made safe, it would be made safe. There is nothing inherent in the country or the climate, or the conditions of working, to prevent this. Nothing stops the way but the lethargic indifference of the public. . . . Where bridges and trestles and permanent way are no longer able to carry the locomotives and rolling stock, we are reminded that the railroad companies are unable to bear the financial stress of renewing structures which have outlived their time. Keeping in mind as we do the enormous sums which appear to be available for constructing extensions and new lines, it seems that, not the want of financial power, but the want of will must be held responsible for much that is reprehensible in the conduct of traffic in the United States.

The immunity which we enjoy in this country from accidents is due to ourselves—that is to say, the traveling public will not put up with the destruction of life, limb, and property brought about by avoidable accidents. Until the inhabitants of the United States act energetically from similar motives the slaughter will continue. It is useless to denounce the single-track system and to hold it responsible for the killing and maiming. The single line can be worked just as safely as the double line if due precautions are taken. With the train staff, or on crowded roads the electric tablet system, it is next to impossible for a collision to occur. In this country the railroad companies grumble at the severity of the precautions which the Board of Trade insist on being taken to secure safety. But the companies are really largely the gainers. Juries never spare them, and the price paid for compensation would, in the long run, be much greater than the outlay rendered compulsory by legislation.

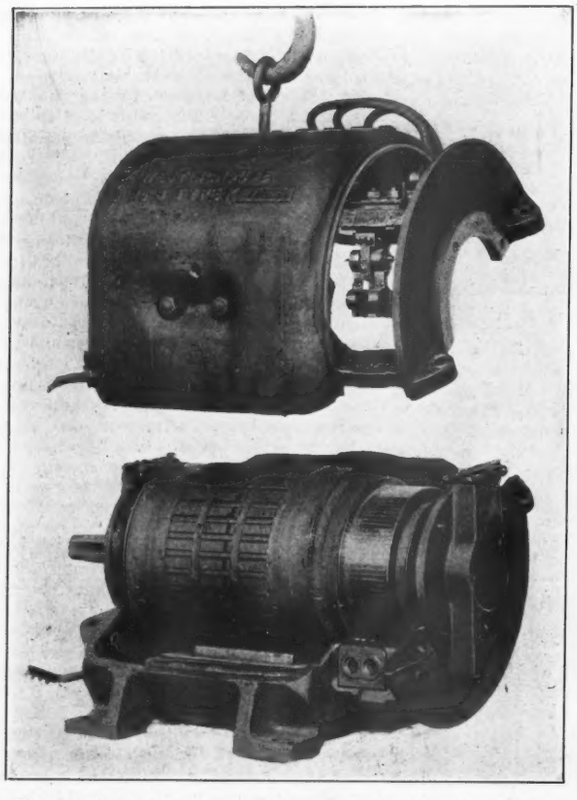
A New Westinghouse Crane Motor.

The accompanying illustrations show the Westinghouse type K motor. This motor is designed for the operation of cranes, hoists and similar apparatus and for intermittent service in which heavy starting torques and wide speed variation are required. This type of motor is made in ten sizes, including capacities from 2 to 40 h.p.

The frames are of the enclosed form, to guard against dirt and moisture, but are designed so that the working parts may be exposed for inspection or adjustment without dismantling. If local conditions permit the cover about the commutator may be removed and the motor operated open, with improved ventilation and increased capacity.



The Westinghouse Type K Crane Motor.



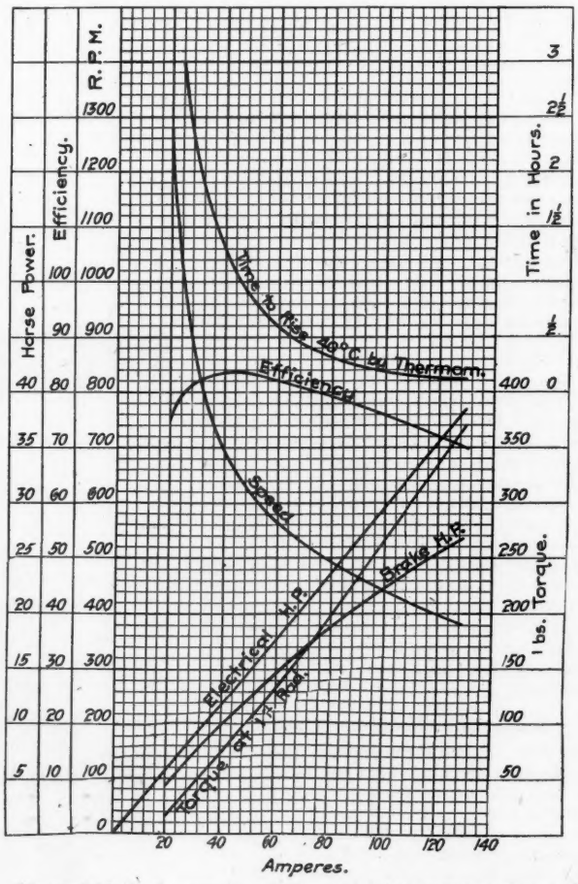
The Westinghouse Type K Crane Motor, Showing Upper Field Raised.

There are four inwardly projecting poles, each of which is magnetized by a separate field coil. It is claimed that this arrangement is superior to that in which but two poles are directly magnetized, the other being consequent, as has been demonstrated in both railroad and industrial service. These motors are series wound and are designed for operation on direct current circuits of 220 and 500 volts. Since the current passes successively through armature and field winding, the torque of such a motor increases nearly as the square of the current, up to the point of saturation of the iron. For this reason the series motor is particularly well suited to the starting and acceleration of heavy loads. Governed by change of voltage at the motor terminals, the speed of the motor is carried through a wide range, the change in the resistance of the motor circuit being made by means of a controller. The motor frames are of cast steel (except in the three smallest sizes, where they are cast iron). They are nearly square in section and two poles project inward in a horizontal and two in a perpendicular plane. The frame is built in two parts, divided in a plane passing through the axis of the armature and at an angle of 34 deg. with the horizontal, an arrangement which allows the upper half of the field to be removed without disturbing the gears or shaft, and makes it easy to take out a pole piece and field coils, or to remove the armature. The lower casting has two finished faces or pads to which bearings for a countershaft may be bolted or which may be used for side mounting. The commutator end of the frame is connected to the poles by six ribs, any two of which may carry the brush holders. The opening around the commutator is entirely closed by a $^{5}/_{32}$ in. sheet steel band, fastened by thumb screws, an arrangement which permits access to the commutator and brush holders at all points.

The four pole pieces are built up of soft steel punchings, riveted together between wrought iron end plates, and are secured to the frame by bolts. The coils of the larger motors are of copper strap and the terminals are insulated with asbestos ribbon. Being machine wound, they are perfectly interchangeable. The coils are fitted to the pole pieces, protected at the ends by oiled duck and held in place by the spreading tips of the pole pieces.

The bearings are composed of shells lined with bronze or babbitt and mounted in housings which may be removed without separating the motor frame. Cast brass bearings are standard on all sides up to and including the No. 4; on all frames above No. 4 babbitt bearings are used. Grease lubrication is employed in all except the larger sizes—Nos. 9 and 10—the bearings of which are designed for lubrication by oil and waste. Drip cups are provided under the bearings for all motors. The bearing housings may be turned and bolted in several positions without modification of design or the addition of special parts.

The armature core is built up of soft steel punchings of high permeability. These



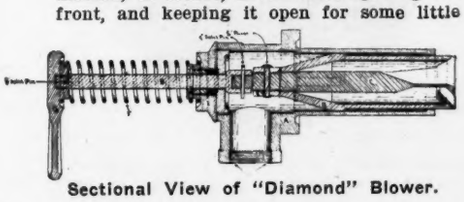
Characteristic Curves No. 6 Type K Westinghouse Crane Motor.

punchings are, in all except the smallest sizes, assembled on a spider and held from turning by steel key. The pinion end is provided with a bell shaped flange, which forms a support and shield for the armature coils. Ducts between the punchings are provided through which air, drawn in through openings in the spider, is forced out against field coils and core, maintaining a uniform temperature throughout all parts of the motor. The commutator is mounted on the armature web, allowing the shaft to be removed without disturbing the winding or connections. The coils are placed in slots and retained by hands laid in grooves below the surface of the core, except in the case of armatures for the Nos. 9 and 10 motors, which have fish paper wedges forced in between V shaped grooves near the top of the slots. Covers of oiled duck protect the ends of the winding. Wiper rings or oil guards are provided at each end of the armature to protect the winding from oil. The shafts may be extended at either end to accommodate pulleys, pinions or brake discs. The commutator is built up of bars of hard drawn copper, insulated by mica, and mounted on the armature spider.

The brush holders are of the sliding type and the individual holders may be independently adjusted. Tension is provided by means of a coiled spring which acts through a short brass strip, so that the spring responds immediately to any movement of the brush, and close contact is maintained at all times. The brush holder arms are secured by stud bolts to surfaces which are machined on the ribs of the frame, parallel to tangents at the points of contact with the brushes. Adjustment to compensate for wear of the commutator can be made by removing the iron washers which are placed under the insulating washers on the stud bolts. With all but the two smaller sizes a shunt is connected to the tip of the spring, extended back over the spring and fastened to the brush holder, thus relieving the spring of the duty of carrying current, insuring good contact, low operating temperature and a permanent and even tension. With every carbon brush 5/8 in. or more in thickness an additional sheet is provided connecting the carbon to the carbon holder, improving the contact between carbon and holder and preventing the pitting of the brush, besides offering a further protection to the temper of the spring. Flexible leads are brought out through insulating bushings in the upper frame and are either connected to terminal blocks mounted on the top of the motor, or are arranged for direct connection to the controller lines.

The "Diamond" Steam Flue Blower.

The illustration shows a sectional view of the "Diamond" steam flue blower, which is designed to overcome the disadvantages of the old method of a steam or air pipe blowing one flue at a time from the front end of the boiler, against the draft. This latter method, of course, necessitates opening the front, and keeping it open for some little



Sectional View of "Diamond" Blower.

time, cooling the boiler and reducing the steam pressure. Also the soot is blown into the smoke-box and must be removed. The "Diamond" blower is placed at the rear end of the boiler and blows the soot with the draft, and out of the chimney. About five minutes is all that is required to clean a set of flues as it cleans at each operation a cluster 4 ft. 6 in. in diameter.

The steam is admitted through the inlet, H, at the bottom, the pressure forcing out nozzle tube B, and with it nozzle C. Revolving nozzle C by handle G causes the steam to spray through all of the tubes within an area 4 ft. 6 in. in diameter at one time.

Prominent users of these blowers are: The Western Transit Company, Northern Steamship Company and The Mutual Transit Company, all of Buffalo, N. Y., and the Chicago Shipbuilding Company, Chicago. The maker, the Power Specialty Company, Detroit, Mich., will send blowers on trial.

Signal Department of New York Central.

It is announced that beginning with January 1 the signal department of the New York Central will be placed under the supervision of the operating department instead of the maintenance of way department, as heretofore. The signal engineer becomes a signal superintendent and will report to the General Superintendent instead of to the Engineer of Maintenance of Way in all matters pertaining to maintenance and care of signals. The signal supervisors will report to the Division Superintendent in these matters and to the Engineer of Maintenance of Way in all questions involving plans, layouts and new installations. In changes of standards and in new plans the Signal Engineer will concur with the Engineer of Maintenance of Way. The Signal Engineer may call on the Signal Supervisors for reports of performance of signals, but has no direct supervision over them.

Manufacturing and Business.

The Cleveland Punch & Shear Works Co., Cleveland, Ohio, recently shipped one of its automatic spacing tables to the Middletown Car Works, Middletown, Pa.

C. F. Ernst's Sons, of Buffalo, has been incorporated in New York with a capital of $100,000 to make iron and steel by C. K. Ernst and others, of Buffalo.

J. P. Neff, formerly foreman of shops for the Chicago & North Western at Boone, Iowa, took a position in the mechanical department of the American Locomotive Equipment Co., Chicago, on Dec. 1.

The Erie City Iron Works, of Erie, Pa., recently increased its capital stock from $1,000,000 to $2,000,000, and, it is reported, is planning to make large additions to its works now under construction.

The International Machine & Screw Co., of Portland, has been incorporated in Maine with a capital of $500,000 with E. W. Freeman, President, of Portland, and G. T. Warwick, Treasurer, of Springfield, Mass.

F. W. Bird & Son, East Walpole, Mass., maker of the Neponset insulating paper, have received the order for paper to be used in 1,000 refrigerator cars being built by The American Car & Foundry Co. of Chicago.

The National Steel Foundries Co., of New Haven, Conn., according to local reports, has been given a contract to furnish all the steel castings to be used in the London underground railway. The works will be run on full time to fill this contract.

Bankers of New York, Boston and Philadelphia, it is reported, have arranged to build the power canal of the Great Northern Power Co. at Duluth, Minn., and have arranged for a bond issue of $3,600,000 to provide funds for the work.

The Maryland Car Wheel Manufacturing Co., of Cumberland, Md., has been incorporated with a capital of $25,000 to make a self-lubricating car wheel; also various kinds of car and mining supplies, by John Duroth, C. G. Smith and others.

The Canada Foundry Co., of Toronto, it is reported, has bought from the Bucyrus Co., of Cleveland, Ohio, the sole right for Canada to make that company's steam shovels, wrecking cranes and pile drivers, and will enlarge its works to take up this work.

The Pressed Steel Car Company has opened its office in the south, and Mr. L. O. Cameron has been appointed General Sales Agent, Southern District, with headquarters at Atlanta. Mr. Cameron will have charge of all matters pertaining to the sales department in connection with railroads and manufacturing concerns located in the southern territory.

The American Steel Foundries, New York, announces that on Jan. 1, 1905, its engineering department will be placed in charge of Mr. C. M. Mendenhall, with the title of Chief Engineer, and that the following officers will report direct to Mr. Mendenhall: Geo. G. Floyd, Mechanical Engineer; J. V. McAdam, Traveling Engineer; W. Mac Gregor, Construction Engineer.

Mr. C. W. Whitney has resigned his position as Pacific Coast representative of the McGraw Publishing Company, New York, and has become identified with the Abner Doble Company, of San Francisco, engineers and manufacturers of tangential water wheels and needle regulating nozzles. Mr. Whitney will have charge of the Abner Doble Company's publicity department.

The Independent Railroad Supply Co., Chicago, was awarded a silver medal by the Louisiana Purchase Exposition for the Wolhaupter rail joint. Under the rules laid down for the jurors, governing the granting of awards, this was the highest award possible to obtain. The company has just re-

ceived orders for these rail joints from the Cincinnati, Hamilton & Dayton and Chicago & Western Indiana, and recently shipped an order to the Michigan Central.

Contracts for the new boiler and machinery of the electric light station of the Holyoke (Mass.) municipal plant were let recently. The contract for the 500 k.w. generator has been given to the General Electric Co. for $18,000, which includes a steam turbine to operate it. The contract for three 250 h.p. Manning steam boilers was given to Coghlan's Holyoke Steam Boiler Works for $6,600. It is expected that the works will be in operation about May 1.

Walter Macleod & Co., Cincinnati, send notice of their removal to their new factory and offices at 213 East Pearl street. They own this new plant, which has over 20,000 sq. ft. of floor space in the factory. The notice is in the form of a handsome calendar for 1905. Accompanying it is a pamphlet describing Macleod's labor-saving specialties, including oil burners for light and heat, oil furnaces and forges, sand blast machines, white washing and painting machines and acetylene outfits.

The New Milford (Conn.) Power Co., which furnishes power for the electric railroads in Waterbury, New Britain, Plainville, Cheshire, Bridgeport, Greenwich, Milford, Southington, Norwalk and Naugatuck, it is reported, has been sold to New Haven capitalists. The company has an extensive plant in New Milford and auxiliary works are being built at Boardman's Bridge. The officers of the company are: President, Winthrop G. Bushnell; Vice-President, Louis E. Stoddard; Secretary and Treasurer, Samuel C. Morehouse. The headquarters of the company will be at New Haven.

Contracts aggregating $500,000, reports from Pittsburg state, have been given to the Westinghouse Companies for the complete equipment of the Rochester, Syracuse & Eastern Railroad, to be built by the Syracuse Construction Co. The contracts are divided between the Westinghouse Electric & Manufacturing Co. and the Westinghouse Machine Co. The former will furnish two 2,000 h.p. generators, two 750 h.p. and six 600 h.p. rotary converters and five 600 k.w. step-up transformers with 33,000 volts capacity. Equipment will also be furnished for 22 cars requiring 84 motors. There will be 12 quadruple equipments of 110 h.p. each, two 75 h.p., four 40 h.p., two 30 h.p., and two double 30 h.p. The Westinghouse Machine Co. will build two 2,000 h.p. steam turbines.

Iron and Steel.

The Illinois Steel Co. will soon start its two largest mills and its entire steel plant, which have been idle for some months. The company proposes to resume work January 2 in its rail and steel mills.

Contracts aggregating several hundred thousand dollars, it is reported, have been given for building the new hoop mill of the Sharon Steel Hoop Co. at Sharon, Pa., which is to be in operation about June 1 of next year.

At a meeting in Pittsburg December 22 of steel sheet and tin plate makers, including the American Steel & Tin Plate Co., it was decided to raise the prices on these products $2 a ton, which makes the official quotation on black sheets of No. 28 gage $2.38 per hundred lbs. The demand for sheets and tin plates is increasing daily and is now greater than the mills can meet. The American Sheet & Tin Plate Co. has more than 90 per cent. of its capacity in active operation and expects very soon to have all its mills running on full time.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies see advertising page 24.)

Western Society of Engineers.

At an extra meeting held Dec. 21 the subject presented was "The Construction of Part of the Intercepting Sewers of Chicago from 39th Street to 63d Street." Two papers were read, the authors being Mr. W. A. Shaw and the late Mr. Guy Miltimore.

Railway Club of Pittsburg.

At the regular meeting of this club December 23, an address was delivered by J. W. Wardrop on "The Merchants' and Manufacturers' Association and Its Relation to the Railroad and Business Interests of Pittsburg." The meeting was also addressed by Colonel J. N. Schoonmaker, J. F. Townsend, William Kirk, D. F. Hurd and others.

The Railway Signal Association.

The next meeting of this Association will be held at the Grand Union Hotel, 42d street and Broadway, New York City, at 2 p.m., on Tuesday, January 10. Mr. Edward T. Reynolds will read a paper on storage batteries for block signals, and the committee report on Standard Specifications for Mechanical Interlocking and for Material for Construction Work will be discussed, beginning with paragraph 15. Paragraphs 1 to 14 inclusive were revised and adopted at the annual meeting in St. Louis, October 11.

PERSONAL.

—Mr. A. S. Ostrander, formerly Superintendent of the Air Line Division of the New York, New Haven & Hartford, died at West Lynn, Mass., last week at the age of 56.

—Captain George H. Power, for more than half a century a prominent business man of Hudson, N. Y., died in that city on December 21, at the age of 87. Capt. Power's early business career was in boating on the Hudson River. He was the chief owner of the Hudson & Berkshire Railroad, which is now the Hudson branch of the Boston & Albany.

—Mr. William Howard Courtenay, the new Chief Engineer of the Louisville & Nashville, is a native southerner, having been born in Louisville in 1858. Mr. Courtenay is a graduate of Rensselaer Polytechnic Institute, class of 1879. Shortly after graduating he entered the service of the Louisville & Nashville as an Engineer and served in that capacity until 1891, when he was appointed to the position from which he is now promoted, that of Principal Assistant Engineer. He will assume his new duties on the first of the coming month.

—Announcement is made of the death of Sir Lowthian Bell, at the age of 88. Sir Lowthian, who was the third president of the Iron and Steel Institute, holding office from 1873 to 1875, and the first recipient of the Bessemer Gold Medal, in 1874, was a Fellow of the Royal Society, a member of the American Philosophical Institution, and an ex-Mayor of the City of Newcastle. He was well-known as a representative of the iron, steel and coal industries of Great Britain, and published books on the chemistry of the blast furnace and the principles of the manufacture of iron and steel. He was largely interested in the Clarence Iron Works, and was director of the North Eastern Railway. He was born in 1816; was created a baronet in 1885, and is succeeded in the title by his son, Thomas Hugh.

—Mr. J. C. Vining, the new General Superintendent of the Colorado Midland, was born in Richmond, Va., 39 years ago, and began work as a telegraph operator in 1879. For about a year he worked in Ohio and later went to St. Paul as operator on the North-

ern Pacific and worked for that company until 1884, during which time he was employed as operator, brakeman and conductor, running "the front" train laying track. Mr. Vining also served on the Southern Pacific, the Santa Fe and the Mineral Belt Railway in Arizona, which road was abandoned after 40 miles of rough work had been done. In April, 1891, he went to the Rio Grande as waybill clerk, subsequently being promoted to the position of local freight agent at Denver. In 1904 he went to the Colorado Midland as Trainmaster, and was later promoted to be Superintendent of Transportation, from which position he is now promoted to the new position just created, that of General Superintendent.

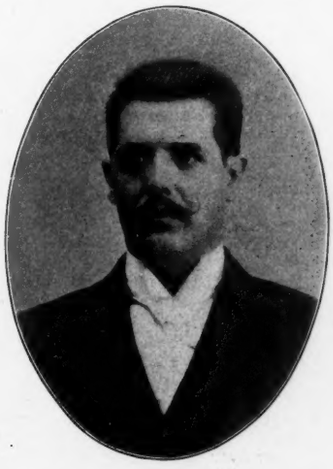
—Mr. C. W. Kinney, who recently succeeded Mr. Baxter as Superintendent of the Pennsylvania Division of the Lehigh Valley at Sayre, Pa., has been in the service of that company since 1886. He began as a tele-

graph operator on the New Jersey Division. In 1892 he was made train despatcher of that division at Perth Amboy and was transferred, with the office, to Easton in 1898. He was then promoted to be chief despatcher at that point and in the fall of 1904 was made Trainmaster, from which position he is now promoted to be Superintendent at Sayre.

—Mr. F. W. Hawks, Chief Engineer of the Evansville & Terre Haute and the Evansville & Indianapolis, was born at Decatur, Mich., 39 years ago. Mr. Hawks was graduated from the High School at that place and began work as a Deputy County Surveyor. His first railroad work was in 1889, when he began as a draftsman on the Chicago Great Western. In 1892 and 1893 he was on

the Chicago & Eastern Illinois, and in 1895 was appointed Assistant Engineer of Maintenance and Construction on the Chicago, Peoria & St. Louis. For the next six years he was Assistant Engineer on the Chicago & Eastern Illinois. In 1903 he had charge of the construction of 62 miles of line for this company. Mr. Hawks was appointed to his new position on the Evansville & Terre Haute in November last.

—Mr. Gustavo Navarro, Superintendent of Motive Power and Machinery of the Vera Cruz & Pacific, began work in 1883 as an apprentice on the Mexican Central. For a time he was in Panama as a locomotive engineer, and then went to the main shops of the National Railroad of Mexico at the City of Mexico. In 1889 he was employed by S. Pearson & Son on the great canal for the drainage of the Valley of Mexico, acting



as contractor and machinist until 1893. The next year he went to the Mexican Southern, and in 1895 went to the Tehuantepec National as Superintendent of Motive Power and Machinery. In 1897 Mr. Navarro was sent by the Mexican Government to the United States navy yard at Norfolk, and upon his return to Mexico again entered the service of the Tehuantepec National. For a time he engaged in mining. In 1902 he was given the contract to widen the locomotives of the National from narrow to standard gage, and was subsequently appointed Master Mechanic. In 1903 he went to Acambaro as Master Mechanic of the Pacific Division, from which position he resigned to go to the Vera Cruz & Pacific as Master Mechanic at Tierra Blanca; and about one month later was promoted to be Superintendent of Motive Power and Machinery.

—Colonel Alexander S. Johnson, who died in Dallas, Texas, last week at the age of 72, was for many years land commissioner of the Gulf, Colorado & Santa Fe.

ELECTIONS AND APPOINTMENTS.

Atchison, Topeka & Santa Fe (Coast Lines).—J. B. Phillips, Machine Foreman of the San Bernardino Shops, has been appointed General Foreman, locomotive shops, succeeding W. L. Essex, resigned.

Atlanta, Knoxville & Northern.—See Louisville & Nashville.

Atlantic Coast Line.—W. B. Denham, hitherto General Superintendent at Savannah, Ga., has been transferred to Wilmington, N. C., as Chief Assistant to the Fourth Vice-President and General Manager. Mr. Denham has been succeeded at Savannah by Newton Riddell.

Baltimore & Ohio.—W. C. Loree, General Superintendent at Pittsburg, Pa., will on January 1 be transferred to Wheeling, W. Va., as General Superintendent of the Wheeling Division, to succeed T. J. Foley, resigned. Robert Finney, General Agent at Pittsburg, has been appointed to succeed Mr. Loree.

Chicago, Burlington & Quincy.—W. F. Hayes, hitherto Acting Superintendent of Bridges and Buildings at Creston, Iowa, has been transferred to be Superintendent of Bridges and Buildings of the Burlington Division at Burlington, J. G. Woodworth, Assistant to the First Vice-President, has resigned. W. E. Crane, Coal Traffic Manager, has resigned. (See Northern Pacific and the Ft. Smith & Western.)

Chicago, Rock Island & Pacific.—G. W. Duback, General Baggage Agent, has resigned.

Fort Smith & Western.—W. E. Crane, hitherto Coal Traffic Manager of the Chicago, Burlington & Quincy at Chicago, has been appointed General Manager of the Ft. S. & W., with headquarters at Ft. Smith, Ark., succeeding the late J. J. Mahoney.

Grand Trunk.—U. E. Gillen has been appointed Assistant Superintendent at London, Ont., succeeding J. W. Higgins, resigned. The office held by Mr. Gillen, Assistant Superintendent of the 5th, 6th and 7th Districts, has been abolished. H F. Coyle, Trainmaster at Belleville, will have charge of matters pertaining to transportation.

Iowa Central.—See Minneapolis & St. Louis.

Lehigh Valley.—J. H. Jacoby, Superintendent of Telegraph, has resigned, and the office has been abolished.

Louisville & Nashville.—R. Montfort has been appointed Consulting Engineer, with office at Louisville, Ky. W. H. Courtenay, hitherto Principal Assistant Engineer, has been appointed Chief Engineer, succeeding Mr. Montfort. T. E. Brooks has been appointed Superintendent of the South & North Alabama R. R. and the Birmingham Mineral Division of the L. & N., with office at Birmingham, Ala. J. R. Wheeler, hitherto Assistant Superintendent at Birmingham, Ala., has been appointed Superintendent of the Nashville Division, with headquarters at Nashville, Tenn., succeeding Mr. Brooks.

The Knoxville, LaFollette & Jellico Railroad, extending from Saxton, Ky., to Knoxville, Tenn., and the Atlanta, Knoxville & Northern Railway, extending from Knoxville, Tenn., to Marietta, Ga., with branches will after January 1 be operated as a part of the L. & N. Until further notice, E. E. Snyder, Superintendent of the Louisville Division, will be in charge of the line from Saxton to the north end of Dossett tunnel. C. W. Bradshaw has been appointed Superintendent in charge of the line from the south end of Dossett tunnel to Marietta, including branches, with headquarters at Blue Ridge, Ga.

Minneapolis & St. Louis.—J. N. Tittemore, Traffic Manager of the Iowa Central, has been appointed Traffic Manager of the M. & St. L., succeeding W. H. Hopkins, General Freight Agent, resigned. Mr. Tittemore will continue as Traffic Manager of the Iowa Central.

Missouri Pacific.—J. W. Higgins, hitherto Assistant Superintendent of the Grand Trunk at London, Ont., has been appointed Inspector of Transportation of the M. P., with headquarters at St. Louis.

Morgan's Louisiana & Texas.—F. E. Batturs, hitherto Assistant General Passenger Agent, has been appointed General Passenger Agent, in charge of Southern Pacific lines in Louisiana.

New York Central & Hudson River.—P. E. Crowley, hitherto Superintendent of the Pennsylvania Division at Corning, N. Y., has been appointed Assistant General Superintendent, with headquarters at Syracuse.

New York, New Haven & Hartford.—A. R. Whaley, hitherto Superintendent at Providence, R. I., has been appointed Superintendent of the New York Division, succeeding T. H. Fennell, who, on account of ill health, has been relieved of the Superintendency of that division. C. F. Kennedy has been appointed to succeed Mr. Whaley as Superintendent of the Worcester Division.

Northern Pacific.—J. G. Woodworth, hitherto Assistant to the First Vice-President of the Chicago, Burlington & Quincy, has been appointed Traffic Manager of the N. P.

Philadelphia & Reading.—George Ziegler, hitherto Assistant Comptroller, has been appointed Comptroller of the Reading and controlled lines, succeeding Daniel Jones, resigned.

South & North Alabama.—See Louisville & Nashville.

Suffolk & Carolina.—C. L. Hutchins, hitherto Auditor, has been appointed General Manager, succeeding G. L. Barton, resigned.

Tennessee Central.—L. F. Lonnbladh, hitherto Acting Engineer of Construction, has been appointed Chief Engineer, succeeding W. N. McDonald, Engineer of Maintenance of Way, resigned. O. M. Laing, hitherto General Storekeeper, has been appointed Purchasing Agent.

LOCOMOTIVE BUILDING.

The Detroit & Mackinac will order two locomotives.

The Toledo, Peoria & Western has ordered five 10-wheel (4-6-0) locomotives from the Baldwin Locomotive Works.

The Canadian Pacific is reported to have ordered 30 (4-6-0) locomotives from the Locomotive & Machine Co. of Montreal, Ltd.

The Canadian Pacific has ordered 10 Mogul (2-6-0) locomotives from the Canadian Locomotive Co., Kingston, Ont. These locomotives are for delivery within 10 months.

The Queen & Crescent, as reported in our issue of December 9, has ordered 13 consolidation (2-8-0) locomotives from the American Locomotive Co. Eight of these are for the Alabama Great Southern and five for the Cincinnati, New Orleans & Texas Pacific. The locomotives will weigh 200,000 lbs., with 180,000 lbs. on drivers; cylinders, 22 in. x 30 in.; diameter of drivers, 56 in.; straight boil-

er, with a working steam pressure of 200 lbs.; heating surface, 3,517 sq. ft.; 437 charcoal iron tubes, 2 in. in diameter and 14 ft. 6½ in. long; carbon steel fire-box 108 in. long and 72½ in. wide, grate area, 53 sq. ft.; tank capacity, 6,000 gallons of water, and coal capacity, 12½ tons. Special equipment includes: Westinghouse brakes, Gollmar bell ringers, Keasbey & Mattison magnesia boiler lagging, Simplex brake-beams, Tower couplers, Dressel headlights, Monitor injectors, Ajax journal bearings, U. S. piston rod and valve rod packings, Coale safety valves, Nathan sight-feed lubricators, Railway Steel-Spring Co.'s springs, Ashton steam gages and Latrobe driving, truck and tender-wheel tires.

The Michigan Central, as reported in our issue of December 23, has ordered 14 compound Consolidation (2-8-0) locomotives, three simple Pacific type (4-6-2) locomotives, and 17 simple 10-wheel (4-6-0) engines from the American Locomotive Co. The (2-8-0) locomotives will weigh 198,500 lbs. with 174,000 lbs. on drivers; cylinders 23 and 35 x 32 in.; diameter of drivers, 63 in.; straight boiler with a working steam pressure of 210 lbs.; heating surface, 3,091 sq. ft.; 359 tubes, 2 in. in diameter and 15 ft. 7 in. long; wide steel fire-box, 96⅛ in. long and 75⅛ in. wide; grate area, 50 sq. ft.; tank capacity, 6,000 gallons, and coal capacity, 12 tons. The (4-6-2) locomotives will weigh 221,000 lbs., with 140,500 lbs. on drivers; cylinders, 22 in. x 26 in.; diameter of drivers, 75 in.; straight boiler with a working steam pressure of 200 lbs.; heating surface, 3,897 sq. ft.; 354 tubes, 2 in. in diameter and 20 ft. long; wide steel fire-box, 96⅛ in. long and 75¼ in. wide; grate area, 50 sq. ft.; tank capacity, 6,000 gallons of water, and coal capacity, 12 tons. The (4-6-0) locomotives will weigh 154,200 lbs.; cylinders, 19½ in. x 26 in.; diameter of drivers, 64 in.; extended wagon-top boiler with a working steam pressure of 200 lbs.; heating surface, 2,612 sq. ft.; 314 tubes, 2 in. in diameter and 14 ft. 8 in. long; fire-box, 108 3/16 in. long, and 41½ in. wide; grate area, 31 sq. ft.; tank capacity, 5,100 gallons of water, and coal capacity, 12 tons. Special equipment includes: Westinghouse air-brakes, Chicago Railway Equipment Co.'s brake-beams, National-Fulton journal bearings, U. S. metallic piston rod and valve rod packings, Leach sanding devices and Detroit sight feed lubricators.

CAR BUILDING.

The American Car & Foundry Company has miscellaneous orders for 181 cars.

The Long Island has ordered 122 passenger coaches from the American Car & Foundry Co.

The Denver, Northwestern & Pacific denies being in the market for three passenger coaches, as reported in our issue of December 16.

The Underground Electric Railways (London) have ordered 36 motor car bodies and 72 trailers from the American Car & Foundry Co.

The National Coal Dump Car Company has ordered 450 dump cars from the American Car & Foundry Co. These dump cars are for the Illinois Central.

The Chicago, Rock Island & Pacific has ordered 25 combination stock cars from the National Coal Dump Car Co., to be built by the American Car & Foundry Co.

The American Car & Foundry Company has received an order for 50 ballast cars. These cars will be used for work on the Flatbush Avenue Terminal of the Long Island.

The San Pedro, Los Angeles & Salt Lake has ordered 200 steel flat cars of 100,000 lbs. capacity from the Pressed Steel Car Co. These cars will weigh 34,500 lbs., and will be 41 ft. 10 in. long and 9 ft. 4½ in. wide.

The Minneapolis, St. Paul & Sault Ste. Marie has ordered 15 cabooses from the American Car & Foundry Co. These cars will be 21 ft. 2 in. long and 8 ft. 9 in. wide, over sills; and 15 ft. 7½ in. high from top of cupola.

The Grand Trunk Pacific is reported to have made a contract with the Canada Car Co. The contract specifies the delivery of 15 cars a day for five years as soon as the plant of the Canada Car Co. at Montreal is completed.

The Howland Improvement Company, Goldsboro, N. C., has ordered 90 ventilated freight cars of 60,000 lbs. capacity from the South Baltimore Steel Car & Foundry Co. for January, 1905, delivery. The cars will weigh 24,000 lbs., and will be 36 ft. long, 8 ft. 6 in. wide and 7 ft. 6 in. high.

The Michigan Central has ordered 1,500 box cars of 80,000 lbs. capacity, 500 40 ft. refrigerator cars of 60,000 lbs. capacity, and 300 stock cars of 60,000 lbs. capacity from the American Car & Foundry Co. The box cars will weigh 36,000 lbs. and will be 36 ft. long, 8 ft. 6 in. wide, and 8 ft. high, inside measurement. The stock cars will be 40 ft. long, 8 ft. 5 in. wide and 7 ft. 6 in. high. Special equipment for all includes: Simplex bolsters, Westinghouse brakes, Smith doors for box cars, Miner draft rigging, Harrison dust guards, arch-bar trucks and Hutchins inside metal roofs for box cars.

The Pittsburg Coal Company, as reported in our issue of December 23, has ordered 2,000 twin hopper gondolas of 80,000 lbs. capacity from the American Car & Foundry Co., date of delivery commencing March, 1905. These cars will weigh 37,000 lbs., and will be 36 ft. 6 in. long, 9 ft. 7 in. wide and 4 ft. 2 in. high, inside measurement, with steel frames and underframes. Special equipment includes: Bettendorf and Simplex bolsters, Westinghouse air-brakes, Climax couplers, Simplex brake-beams, McCord journal boxes and journal box lids, Miner draft rigging, Union Steel and Railway Steel-Spring Co.'s springs, National-Fulton and Damascus brasses with Climax bearing keys and Diamond arch-bar trucks.

BRIDGE BUILDING.

DALLAS, TEX.—According to reports, the Missouri, Kansas & Texas is planning to put in about 10 new steel bridges on its Dallas division.

EAU CLAIRE, WIS.—The City Council, it is reported, has given a contract to George Nelson at $34,167 for building a concrete and steel arch at Barstow street.

FREDERICTON, N. B.—C. H. LaBillois, Commissioner of Public Works, is asking for bids for the Forest City bridge and the Five Mile Brook bridge, both in York County.

GERMANTOWN, IND.—The bridge of the Pittsburg, Cincinnati, Chicago & St. Louis over Martindale creek, which is 100 ft. long, has been wrecked. It was pushed from its abutments, and fell a distance of 20 ft. into the stream below, by the wrecking of two flat cars loaded with heavy iron piping which struck the upright pieces of the bridge broadside. Damage about $25,000.

HARRISBURG, PA.—Nelson & Buchanan, of Chambersburg, has been given the state contract to build a bridge over Nescopeck Creek, in Luzerne County, for $10,844. The Penn Bridge Co., of Beaver Falls, was given the contract for the bridge at Swelyville over the Lackawaxen River, in Wayne County, at its bid of $16,100. There were 32 bids.

Bids are wanted January 10 by J. H. Shumaker, Superintendent of Grounds and Buildings, for rebuilding the substructure and superstructure of the highway bridge over Penn's Creek in Hartley township, Union County.

MINNEAPOLIS, MINN.—The bridge of the Minneapolis, St. Paul & Sault Ste. Marie, recently destroyed by fire, will be replaced by a steel bridge.

NORFOLK, VA.—The steel bridge over Mahone's Canal, which is a combined highway and street car bridge, has been damaged by rust and corrosion to such an extent that it may have to be replaced by an entirely new structure.

OSHKOSH, WIS.—Bids are wanted January 14 by the Board of Public Works for building the superstructure of the bridge over Fox river connecting Main and South streets. M. Coffey is a member of the board, and Karl L. Lehman, Consulting Engineer, 910 Operahouse building, Chicago, Ill., will furnish forms for proposals.

PUEBLO, COLO.—The Pueblo Bridge Co., it is reported, has been given a contract at $97,460 to build the viaduct at Main street. It will be 700 ft. long with a roadway of 56 ft. and two sidewalks.

SACRAMENTO, CAL.—The Board of Supervisors of Sacramento County is reported having given a contract to Clark & Henry for building a drawbridge with a draw of 117 ft. over the Sacramento River at Grand Island for $59,763. Objections were made to the bridge unless the draw-opening was widened to 148 ft., which has been consented to, at an increased cost of $4,000.

ST. LOUIS, MO.—The Board of Public Improvements has decided to let contracts at once for building a concrete arch with a 24-ft. roadway and foot paths on each side over the River des Peres in Forest Park, to replace the present wooden structure

ST. PAUL, MINN.—According to reports, the high bridge across the Mississippi recently partly destroyed by wind will be rebuilt at a cost of about $60,000. L. W. Rundlett is City Engineer.

SPRINGFIELD, MASS.—The special commission appointed by the Mayor to consider the problem of building a new bridge across Connecticut river has reported that to avoid building at a high level it is desirable to remove the main tracks and the yards of the New York, New Haven & Hartford to the west side of the river. This would reduce by $350,000 the cost of the highway bridge, but would necessitate the expenditure of a million to change the location of the railroad for 2½ miles. This bold project is favored by the railroad company; and, for the million expenditure, the city would in return have the present right of way of the railroad for a great river front park. If the railroad were to be changed, it would cross from the east to the west side of the river three miles below the city and would return to the east side at the point where now the Boston & Albany crosses. This plan would necessitate two bridges over Agewam river and the construction by the Boston & Albany of a four-track bridge to make room for the New Haven. The Boston & Albany would also have to widen its road for some distance east of the river. The plan contemplates the establishment of new freight yards for the New Haven road east of the union passenger station and south of the Boston & Albany.

Bids are wanted by the County Commissioners January 11 for the removal and rebuilding of the stone piers and abutments for the new bridge to be built over the Connecticut River between West Springfield and Chicopee. The upper portions of the six existing piers and two abutments will be removed and rebuilt, and approximately 1,150 cu. yds. of masonry is to be removed and replaced. Robert O. Morris is Clerk.

TORONTO, ONT.—The Canada Foundry Co., Ltd., of this place, it is reported, has been given a contract by the Canadian Northern to build the steel superstructure of a bridge 1,870 ft. long over the North Saskatchewan river.

WAYNESBORO, PA.—Petition has been made to the court for a bridge to be built over the Antietam Creek.

Other Structures.

ALEXANDRIA, VA.—The Washington Southern, reports state, is asking bids January 2 for putting up a brick passenger station 33 x 96 ft. and a baggage room 33 x 41 ft.

BUFFALO, N. Y.—The Union Station Com-

mission, according to reports, has got the approval of the railroads of its plans for a new union passenger station.

CHICAGO, ILL.—According to newspaper reports from Chicago, the Pennsylvania is making elaborate plans for a new passenger station to be built on the site of the present union station.

DALLAS, TEX.—A contract is reported having been given to J. C. McCord for putting up a brick car barn for the Dallas Consolidated Electric Street Railway Co. 94 x 305 ft., to cost about $15,000.

GREENSBORO, N. C.—The Southern Railway, according to local reports, will make improvements to cost $45,000, to include an addition to the present freight house, which is one story high and extending 250 ft. towards Davie street, and the building of a transfer shed 15 ft. wide and 750 ft. long.

GULFPORT, MISS.—The Gulf & Ship Island, it is reported, will begin work early in January on a new pier as large as the one already constructed, which is about one mile long.

KNOXVILLE, TENN.—The Knoxville Construction Co. has given the contract and work on the substructure has been commenced for its new brick car barns 250 x 300 ft. at Park avenue. Contracts for the brick work will soon be let.

LANCASTER, PA.—The Pennsylvania Railroad has notified the city authorities that it will build a tunnel at Prince and Walnut streets.

LOUISVILLE, KY.—According to local reports, a contract has been given by the Louisville & Nashville to the American Bridge Co. at $200,000 for the steel skeleton of its proposed nine-story office building.

MEMPHIS, TENN.—Plans are being made and bids will soon be asked for building a large elevator on the river front for the Lee line to cost about $100,000.

RENOVO, PA.—The Pennsylvania, it is reported, is planning to build an extension to its erecting shop 160 ft. long and to put up a new machine shop 80 x 280 ft. The foundation work is reported under way, but the company is not yet ready to receive bids for the buildings.

SCHENECTADY, N. Y.—Plans, it is reported, are under way for the building by the New York Central of a passenger station for the use of that company and the Schenectady Railway Co.; and it is also proposed to build a viaduct at the State street crossing.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ATLANTA, KNOXVILLE & NORTHERN.—This company is rebuilding 60 miles of its line from Knoxville south to Etowah, Tenn., and there will be practically a new roadbed for the entire distance. W. J. Oliver & Co., of Knoxville, are the contractors. It is expected to begin track laying about March 1, and to have the line ready for operation by July 1. Grading is also in progress on an extension from Etowah, Tenn., to Cartersville, Ga., 90 miles. The contractors for this portion of the line are Wright, Williams & Wadley, of Birmingham, Ala. This extension will probably be finished before the end of 1905.

CHICAGO, ROCK ISLAND & PACIFIC.—It is reported that this company is preparing to build an extension from Knoxville, the present terminus of the Washington divison, to Indianola, Iowa, 28 miles. Surveys have been finished and estimates of the probable cost have been made. It is stated that a spur line will also be built from Knoxville to coal regions in Marion County, Iowa.

COLORADO, NEW MEXICO & GULF.—Articles of incorporation have been filed by this company in Colorado. It is proposed to build a railroad in the state of Colorado and New Mexico. W. S. Hopkins, of Hillsboro, N. Mex., is named as an incorporator.

DURANGO, ALBUQUERQUE & GULF.—This company, which was recently incorporated in New Mexico, proposes to build a railroad from San Felipe through Bernalillo, McKinley and San Juan counties, New Mexico, to a point in La Plata County, Colo., 220 miles. W. H. Andrews and W. S. Hopewell, both of Santa Fe, N. M., are said to be interested. (December 16, p. 197.)

DYERSBURG NORTHERN.—This company has been incorporated in Tennessee to build a railroad from Dyersburg north to Tiptonville, in Lake County, 3 miles. Connection will be made with the Illinois Central at Dyersburg. George T. Weakley, J. C. Doyle and W. H. Kupe, all of Dyersburg, Tenn., are incorporators.

EASTERN NEW YORK (ELECTRIC).—This company has been incorporated in New York to build an electric railroad from Ballston to Middle Grove, in Saratoga, ten miles. The authorized capital is $100,000. F. H. Beach, George D. Cunningham and B. L. Cole, all of Ballston, N. Y., are incorporators.

FLORIDA EAST COAST.—This company is about to build an extension of its line from its southern terminus at Miami to Key West, 136 miles. This extension will be both unique in its conception and novel in its proposed construction. The Florida East Coast Railroad, as is well-known, is the personal property of Henry M. Flagler, and is located on the eastern rim of the state of Florida, where it is for the greater part of its length in sight of the waters of the Atlantic Ocean. Mr. Flagler has for some time been anxious to reach a nearer point to Havana with his railroad and to this end had a survey made from Miami across the unexplored portion of Florida to Cape Sable. After this survey was made, he decided that this line was not feasible, and he therefore made a survey along the coast and the keys to Key West. He now proposes to build an extension south from Miami across to Key Largo on the neck of land separating Baines Sound from Blackwater Sound, and running thence along Key Largo, Long Key, Upper and Lower Mattecumbe and other keys to Key West. These Florida keys are coral ridges, most of them containing a lake in the center and covered with a thin soil and luxuriant vegetation. Some are scarcely above high water and are only a mangrove thicket. Others are inhabited and cultivated and some contain wells or springs of fresh water. Outside these keys runs the Florida reef, another coral reef that does not reach the surface of the water. Between them is the Hawk channel, which is used by medium-sized vessels. Most of the channels connecting the inside passage with the Hawk channel are small and shallow. As these keys are exposed to the full fury of the tropical storms, the work will involve a large amount of filling on the coral rock foundations. Approximately 35 miles of the line will be over water and the balance over keys partly rock and partly submerged. Most of the keys are destitute of soil, and the only material available nearby for filling is that found in the bars and shoals of pulverized set shell formed near the keys. An examination of the coast charts shows that the building of a road with grade 8 ft. above mean low tide would require about 40,000 cu. yds. of material per mile. At present there are three parties in the field locating this line. They are in charge of J. C. Meredith, Engineer of Construction, whose headquarters are at Miami, Fla. From the terminus at Key West it is proposed to run boats to Havana, 85 miles. It is proposed to build these "ferry" boats large enough to carry freight trains.

GEORGIA, FLORIDA & ALABAMA.—Press reports state that location surveys are in progress for an extension of this road north from Cuthbert, Ga., to Columbus, 50 miles. It is stated that work will be begun on this line as soon as the surveys are completed. (See Construction Supplement.)

GREENVILLE & KNOXVILLE.—Press reports state that work is progressing rapidly on this road between Greenville, S. C., and Riverview, 21 miles, and that 18 miles have already been graded out of Greenville in a northerly direction. E. E. McCollough, Greenville, S. C., is Chief Engineer, and H. M. Prince is President. (December 2, p. 177.)

LOUISVILLE & NASHVILLE.—According to newspaper reports, this company will soon begin rebuilding its Knoxville branch between Lexington, Ky., and Jellico, 65 miles. This branch runs through a mountainous country and a number of steep grades and sharp curves are to be eliminated.

NEWHOUSE, COPPER GULCH & SEVIER LAKE.—Articles of incorporation have been filed by this company in Utah. The proposed route of the railroad is from Newhouse, Beaver County, Utah, to Sevier Lake, in Millard County, 20 miles. Work is reported already in progress. Samuel Newhouse is interested.

NORFOLK & WESTERN.—An officer writes that track has been laid during the past year on the following lines: From Naugatuck, W. Va., to Kenova, 59 miles; North Carolina extension from Blair to Galax, three miles; Widemouth branch from Montcalm, W. Va., down the Bluestone river, 19 miles; Roanoke Belt Line from the main line west of Roanoke to the Winston-Salem district, 2½ miles; Tug Fork branch extension above Gary, W. Va., to reach coal fields, five miles; Radford branch extension from present terminus to Little and New rivers in Montgomery county, Va., four miles; Zenith branch to coal fields of the Zenith Coal & Coke Co. in McDowell County, W. Va., 1½ miles. Work is now in progress on the Iaeger & Southern branch from Iaeger, W. Va., up the Dry Fork branch of the Tug river to reach the coal and coke fields of the Berwind-White Coal Mining Co., 29½ miles, and on the Big Creek branch to a point in Tazewell County, Va., six miles. This work will be completed during the year 1905.

OKLAHOMA CITY, HENRIETTA & ST. LOUIS.—This company has been incorporated in Oklahoma Territory, with headquarters at Oklahoma City. It is proposed to build a railroad from Woodward, Okla. T., to Oklahoma City, and thence to Checotah, Ind. T., a distance of 280 miles. The authorized capital is $3,000,000. J. A. Dibble, J. H. Wheeler, J. W. Shortwell and others, of Oklahoma City, are directors.

PARKERSBURG, POMEROY & WESTERN.—Incorporation has been granted this company in Ohio. It is proposed to build a steam railroad from a point on the Ohio River opposite Parkersburg, W. Va., to Toledo, Ohio. C. F. Evans, J. K. Brandon, C. E. Bryan and F. L. Cooperider are named as incorporators.

PENDLETON SOUTHERN.—A charter has been granted this company in Oregon to build a railroad from Pendleton, in Umatilla County, southwest to Heppner, in Morrow County, 45 miles. C. J. Smith, C. H. Carter, T. C. Taylor and J. R. Raley, of Pendleton, Ore., are named as incorporators.

PENNSYLVANIA COMPANY (NORTHWEST SYSTEM).—This company now has a double-track line through from Pittsburg to Chicago. In the double-tracking of this line (the Pittsburg, Fort Wayne & Chicago) grades and curves have been reduced and many grade crossings abolished, making it practically a new road for much of the way.

PLANT CITY, ARCADIA & GULF.—Articles of incorporation have been filed by this company in Florida. The company proposes to buy 12 miles of railroad already built out of Plant City, belonging to the Warnell Lumber & Veneer Co., and to extend it 75 miles to the Gulf. C. A. Root, D. C. Thompson and William Schneider, of Plant City, Fla., are incorporators.

RED LAKE, MINNESOTA & MANITOBA.—Grading is reported completed on this road from Nebish, Minn., to Bemidji, five miles. It is stated that this portion of the line will be finished before the end of the year. C. M. Amsden, C. A. Smith, C. J. Johnson and others, of Minneapolis, are interested. (July 8, p. 30.)

St. Louis, Brownsville & Mexico.—An officer writes that the branch line from Harlingen Junction to Fordyce, Tex., 55 miles, has been finished and was opened for traffic on December 19. Work is now in progress on an extension between Brownsville and Robstown. W. P. Homan, Corpus Christi, Tex., is Chief Engineer.

Southern.—This company is reported to be receiving bids for building passing tracks between Selma, Ala., and Meridian, Miss., and for grading a spur line 2½ miles long from Mobile Junction, Ala., to a point west of Bessemer.

Virginia Roads.—The Virginia Iron, Coal & Coke Co. is reported to have begun work on a line from Norton, Va., to Stonega, 20 miles. Connection will be made at the latter point with a branch line of the Virginia & Southeastern now building.

Western Maryland.—This company has opened that portion of its Cumberland extension between Big Pool and Hancock, Md., nine miles. This is part of the line which is being built between Big Pool and Cherry Run, 65 miles. (June 17, p. 8.)

RAILROAD CORPORATION NEWS.

Boston Elevated Railroad.—The new tunnel under Boston Harbor from the mainland to East Boston has been leased by the city of Boston to the Boston Elevated Railroad Co. for a term of 25 years dating from 1897. The company is to pay an annual rental of three-eighths of 1 per cent. of the gross receipts each year on all its lines. In addition, the railroad company is to collect from each person passing through the tunnel a toll of one cent which is to revert to the city. The tunnel will be opened December 30.

Canadian Northern.—J. P. Morgan & Co. have bought $5,000,000 bonds of this company. These bonds bear 4 per cent. interest and the proceeds from the sale are to be used in building an extension west from the present terminus in the Saskatchewan valley through the Rocky Mountains to the Pacific. The bonds are guaranteed by the Manitoba Government and are a part of an authorized issue of $9,000,000.

Connecticut Railway & Lighting Company.—Redmond & Co., New York, are offering $500,000 first and refunding mortgage 4½ per cent. gold bonds at 98 and interest. The interest on these bonds is guaranteed by the United Gas Improvement Co., of Philadelphia. The total amount of bonds outstanding under the mortgage is $10,268,600. The net earnings of the Connecticut Railway & Lighting Co. for the three months ending September 30, 1904, were $104,428 after the payment of all interest and taxes.

Dominion Atlantic.—This company, which operates a line from Windsor Junction, N. S., to Yarmouth, 203 miles, with branch lines aggregating 17 miles, has bought the Midland Railway extending from Windsor to Truro, 58 miles.

Grand Trunk.—At a meeting of the stockholders of this company on December 21, the resolution of the directors guaranteeing $7,500,000 4 per cent. bonds of the Grand Trunk Pacific was approved. These bonds have been bought by Speyer & Co., New York, and Speyer Bros., London, and will soon be offered to investors.

Indiana, Illinois & Iowa.—The directors of this company have voted to resume the payment of dividends which were suspended last summer and have declared a dividend of 2 per cent. payable on February 1 to holders of record stock January 21.

Midland Railway.—See Dominion Atlantic above.

New England Railroad (N. Y., N. H. & H.).—The $10,000,000 6 per cent. and 7 per cent. first-mortgage bonds will be paid at maturity on January 1 at the office of the company in Boston, or by J. P. Morgan & Co., New York, who offer to the holders of the bonds the privilege of exchanging their holdings for the consolidated mortgage 4 per cent. bonds on a basis of par and accrued interest for the old bonds and 110 and accrued interest for the new.

New York & Ottawa.—At the foreclosure sale of this company on December 22, the road was bid in for the bondholders, who, it is understood, are acting for the New York Central interests. The price paid was $1,000,000.

New York, New Haven & Hartford.—The Supreme Court of Connecticut has decided unanimously in favor of the corporation in the case of the New York, New Haven & Hartford Railroad Company vs. C. K. Offield, of Chicago. The defendant holds the two remainder shares of the New Haven & Derby Railroad, a subsidiary line leased at 4 per cent. These shares the New Haven Company brought proceedings to condemn under a new and somewhat unique Connecticut statute. Offield asked $2,000 a share for his holding and testified that he had been offered $700 a share. The case may be appealed to the federal courts.

Reading Company.—At a meeting of the directors on December 21, a semi-annual dividend of 1½ per cent. was declared on the $70,000,000 outstanding common stock, payable February 1 to holders of record January 14. The regular semi-annual dividend of 2 per cent. on the second preferred stock was also declared. The surplus over fixed charges and taxes for the fiscal year ending June 30 was $7,283,631. Dividends at the full rate of 4 per cent. on both classes of preferred stock call for $2,800,000, leaving $4,483,631 available for dividends on the common stock, or equal to about 6 per cent.

Richmond, Fredericksburg & Potomac.—An extra dividend of ½ per cent. has been declared, payable January 1, to the holders of the common stock of this company. The usual semi-annual dividend has been 4 per cent.

St. Louis & San Francisco.—J. S. Bache & Co., New York, are offering at 98⅝ the remaining $1,500,000 of this company's total issue of $5,000,000 2½-year 5 per cent. coupon gold notes of $1,000 denomination each due Dec. 1, 1906. These notes are secured by the entire capital stock of the St. Louis & Gulf, and by about 95 per cent. of the $4,000,000 collateral trust 40-year 4 per cent. notes.

This road announces through freight service from Chicago and Kansas City to New Orleans, by way of Tupelo, and Meridian, Miss.

Western Maryland.—At a recent meeting of the State Board of Public Works, it was voted to accept the bid of this company of $155,000 for the state's interest in the Chesapeake & Ohio canal. This interest comprises a majority of the canal stock. With regard to the purchase, Vice-President Landstreet says that the Western Maryland does not intend to use the waterway, but it needs the right of way for its new line now building between Big Pool, Md., and Cherry Run, W. Va., which crosses the canal at eight different points.

Worcester & Southbridge (Electric).—The State Railroad Commission of Massachusetts has authorized the consolidation of the Worcester & Southbridge, the Southbridge & Sturbridge and the Worcester, Rochdale & Charlton Depot Street Railroad Companies. The controlling interest in all of these electric roads is now owned by the New York, New Haven & Hartford. The new company will be known as the Worcester & Southbridge Street Railway Co., and has received permission to increase its capital stock by $100,000. The proceeds from the sale of this stock will be used to purchase the outstanding stock of the Southbridge & Sturbridge and the Charlton Depot lines.

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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

FRIDAY, DECEMBER 30, 1904.

CONTENTS

INDEX

Thirty-seventh Quarto Volume—June 17, 1904, to December 31, 1904

AUTHORS

GENERAL INDEX

[Illustrated articles are indicated thus; Editorials thus†; Contributions thus‡; General News Section References thus* (G. N. S.).]

GENERAL INDEX—Continued.

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NEW PUBLICATIONS.

PERSONAL.

*[Portraits are indicated thus *; Obituaries thus §; All references are to the General News Section.]*

PERSONAL—Continued.

*[Portraits are indicated thus *; Obituaries thus §; All references are to the General News Section.]*

ELECTIONS AND APPOINTMENTS.

[All references are to the General News Section.]

RAILROAD CONSTRUCTION.

[All references are to the General News Section.]

RAILROAD CONSTRUCTION—Continued.

[All references are to the General News Section.]

GENERAL RAILROAD NEWS.

[All references are to the General News Section.]